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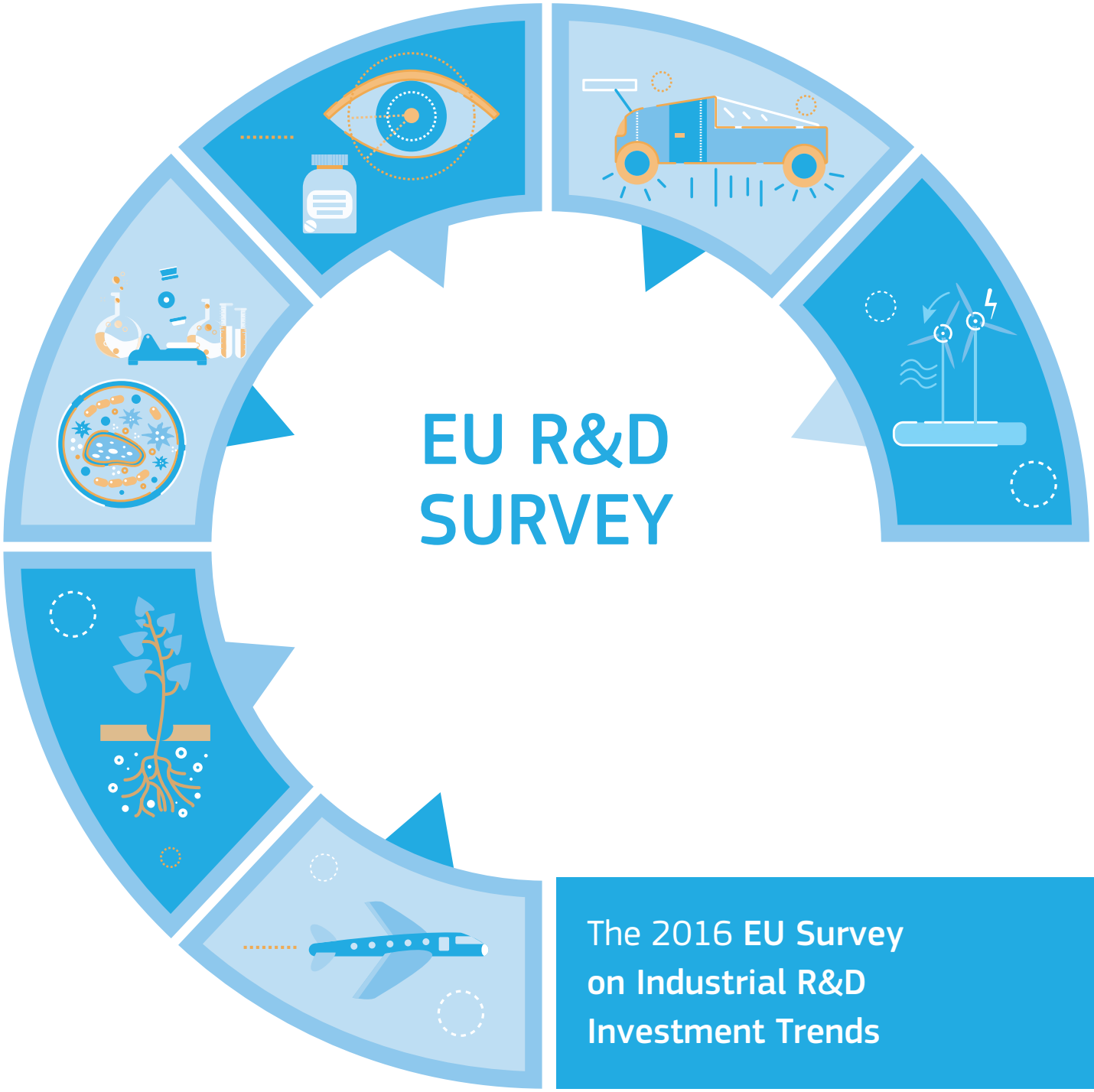

EU R&D SURVEY

The 2016 **EU Survey on Industrial R&D Investment Trends**

EUR 28153 EN

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IRIMA II activities aim to improve the understanding of industrial R&D and Innovation in the EU and to identify medium and long-term policy implications.
The project was coordinated under the leadership of Alessandro Rainoldi (Head of B.3 Territorial Development) and Román Arjona Gracia (Head of DG RTD.A4 Analysis and monitoring of national research policies). This document was produced by Alexander Tübke, Fernando Hervás, Nicola Grassano and Lesley Potters (JRC.B) as the main authors. Héctor Hernández, Sara Amoroso, Mafini Dosso, and Antonio Vezzani from JRC.B and Richard Deiss and Roberto Martino from DG RTD.A made contributions to the design and review of the survey.

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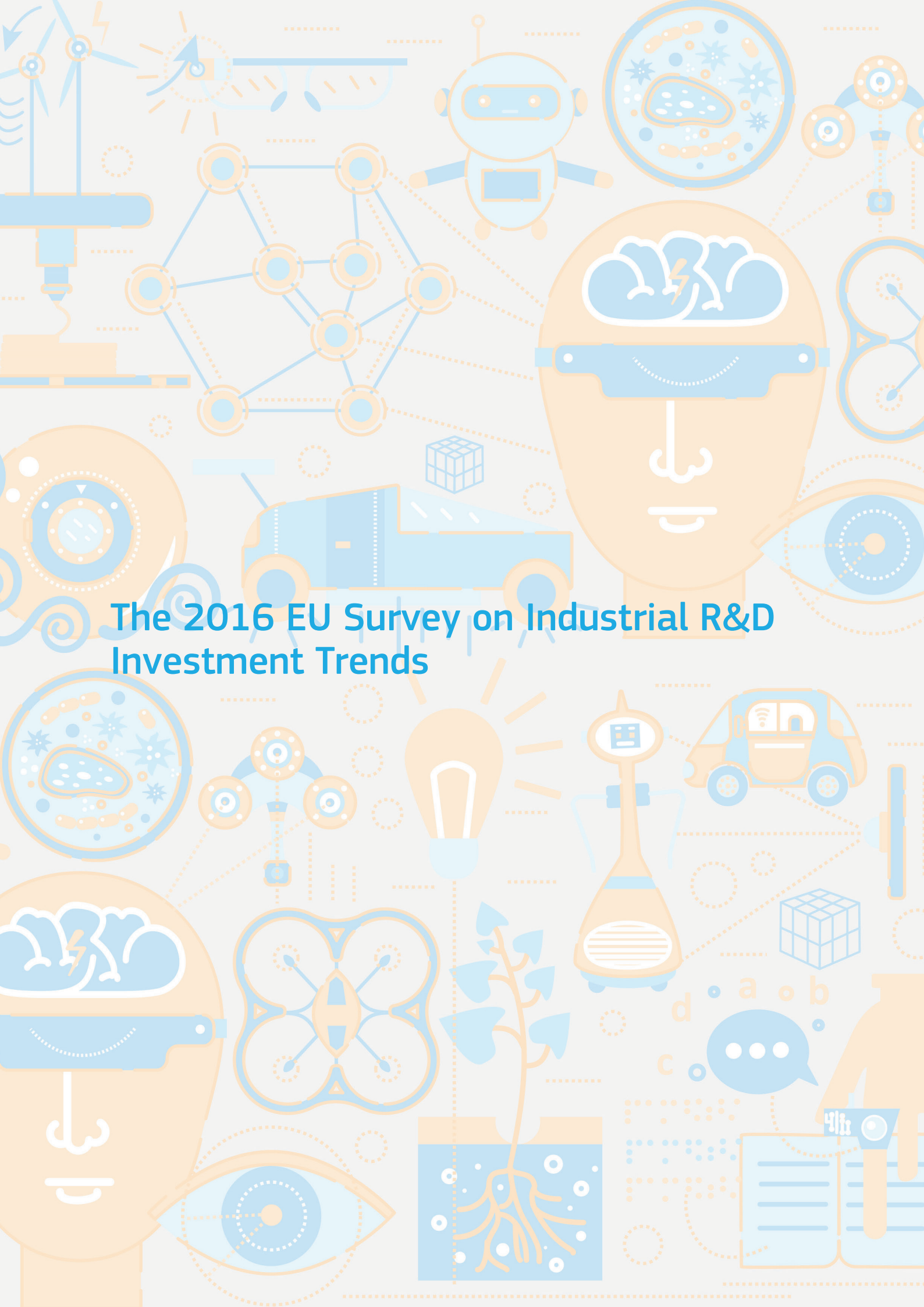
Title
The 2016 EU Survey on Industrial R&D Investment Trends

Abstract

This eleventh survey on industrial R&D investment trends is based on 157 responses of mainly large firms from a subsample of the 1000 EU-based companies in the 2015 EU Industrial R&D Investment Scoreboard. These 157 companies are responsible for €59.3 billion R&D investment, constituting one third of the total R&D investment by the 1000 EU Scoreboard companies.
The responding companies expect to increase their nominal R&D investment by 1.4% per year during 2016–17. This is only half of our previous survey (3.0%) and mainly due to the lack of R&D investment growth expectations of a few very large companies in the automobiles & parts sector. Without this, the expected R&D investment growth of the sample would be 3.8% and thus slightly higher than in the previous survey.
Very similar to last year's survey, the EU-based companies in the sample carry out one-fourth of their R&D outside the EU. The responding companies' expectations for R&D investment for the next three years show the ongoing participation of European companies in the global economy. While maintaining the focus of their R&D investment in the EU, they reap opportunities for growth in emerging economies.

EU R&D Survey

The 2016 EU Survey on Industrial R&D Investment Trends



The 2016 EU Survey on Industrial R&D Investment Trends

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0 SUMMARY

The EU R&D Survey is a yearly survey amongst the top 1000 EU-based R&D investing companies from the R&D Scoreboard. The participating companies cover one third of the total R&D investment by the 1000 companies of the 2015 EU Scoreboard.

Summary

The EU R&D Survey is a yearly survey amongst the top 1000 EU-based R&D investing companies from the R&D Scoreboard. The 157 participating companies in this report declared a total R&D investment from their own resources of €59.3 billion in 2015, or one third of the total R&D investment by the 1000 companies of the 2015 EU Scoreboard.

One of the objectives of the R&D Survey is to get a forward looking indication of R&D trends. The R&D investments expectation for the years 2016 & 2017 is characterised by a **decrease for big companies from the automobiles & parts sector (-0.8%).** This is in stark contrast with the last two R&D Surveys (2014 and 2015) where companies from this sector foresaw a healthy growth figure (around 4%) for the years 2014-15 and 2015-16.

Positive expectations of R&D investments growth are the strongest in the high-tech sectors, specifically in Healthcare, Pharmaceuticals and Technology Hardware, with foreseen growth of around 7-8%.

Overall the companies in the Survey **expect R&D investments to grow by 1.4% p.a. as compared to 3.0% in last year's Survey**. The decrease in growth expectations is mainly due to the earlier mentioned negative expectations in the automobiles sector, which weigh heavily on the overall sample. Without this effect, growth expectations would have been 3.8%.

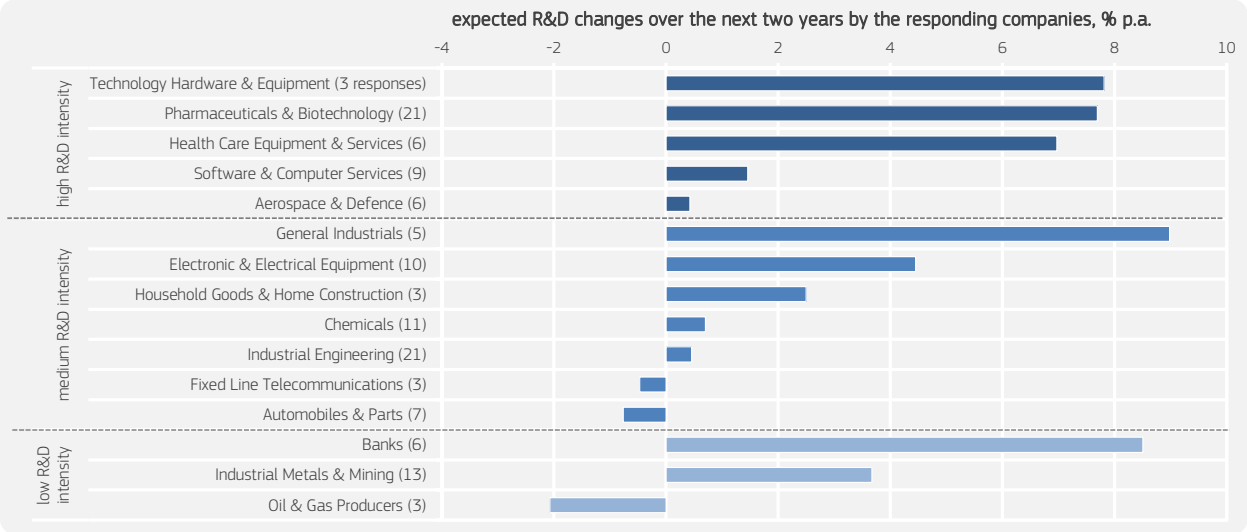


FIGURE 1 – EXPECTED CHANGES OF R&D INVESTMENT OF THE SURVEYED COMPANIES 2015-17, P.A.

Note: p.a. per annum. The figure refers to 117 out of the 157 EU companies in the sample representing 29% of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2016)

Growth expectations also vary by world region. The **EU is the region where the lowest growth is to be expected** (0.5%).

India (10%), the rest of the world[1] (4.6%) and non-EU European countries (4.5%) expect the highest growth.

China shows a striking difference with previous years having passed from double digit expectations to a mere 3.1% due to **shrinkage in the automobiles & parts sector**. Without the companies from the automobiles & parts sector, the expectations for China would be 8 percentage points higher (11.5%) as well as 2 percentage points higher for all the other world regions.

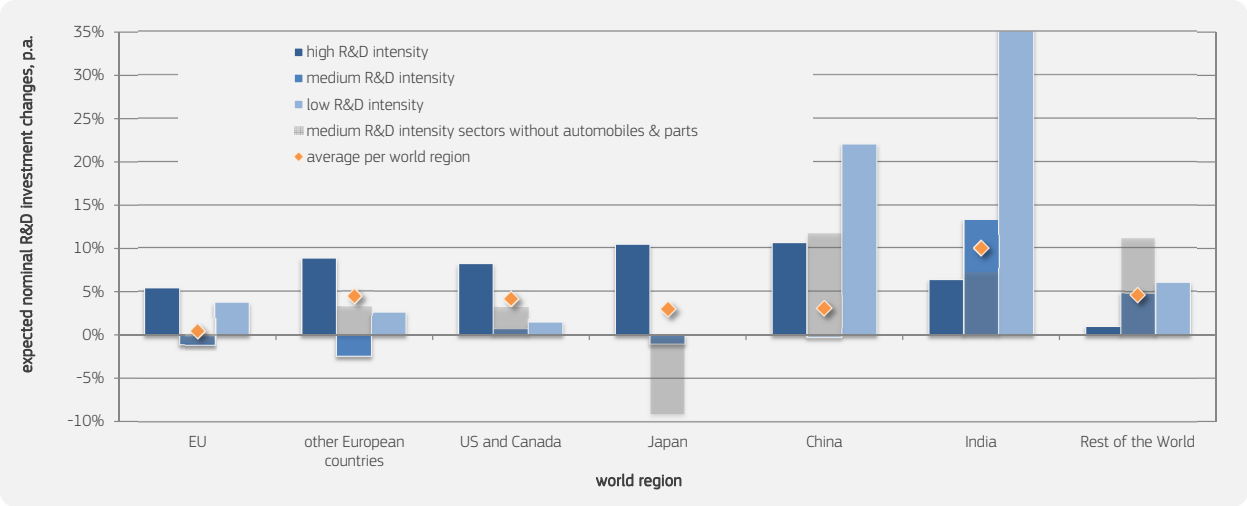


FIGURE 2 – R&D INVESTMENT EXPECTATIONS FOR THE NEXT TWO YEARS, P.A., IN REAL TERMS, BY WORLD REGION & SECTOR GROUP.

Note: The figure refers to 122 (40 high R&D intensity, 56 medium and 26 low) out of the 157 EU companies in the sample, weighted by R&D investment and after elimination of outliers, representing 30% of the total R&D investment by the 1000 EU Scoreboard companies. Other EU countries include Switzerland, Norway and others, while the rest of the world includes a heterogeneous set of countries such as South Korea, Taiwan, and Brazil. See also Annex B: Questionnaire question D.8 R&D location strategy.

Source: European Commission JRC-B (2016)

[1] Countries outside the EU, US and Canada, China, Japan and India.

Path-dependency seems to be an important factor in the location of R&D activities: 83% of the companies mention the home-base as the main R&D location. At the same time, however, **internationalisation** is a widespread phenomenon amongst the top investors. Almost two-thirds of the Survey participants perform R&D in at least three different countries, while only 12% performs R&D in a single country. Also, two-thirds of the companies declare to have R&D activities in the three main regions (North-America, EU and Asia).

Companies tend to **concentrate** R&D activities in fewer locations than production activities: 34% of the companies perform R&D in 1 or 2 locations, while for production this is only 17%. There is certainly an overlap of locating R&D and production activities: 75% of the companies in the Survey perform the highest share of their R&D at the place where also the main production activities are. This is equal amongst the sector groups.

The automobiles & parts sector remains the largest employer for highly-skilled workers in the EU. The sectors aerospace & defence, chemicals, oil & gas producers are characterised by a high share of R&D employees as of total employees, probably due to the combination of highly specialised technical activities with development or laboratory activities and are therefore key in creating high-skilled employment.

The **type of R&D undertaken** varies by sector. The automobiles & parts companies spend almost 80% in technology development, followed by 10% in software development. The technology hardware & equipment companies also have a high proportion of technology development (55%) but instead spend 10% in management on R&D projects and surprisingly not in software development. The profile from the pharmaceuticals & biotechnology companies is much different: almost 60% of their R&D is spent on market launch (which presumably includes very costly clinical testing and regulatory approval activities) and only 20% on technology development.

A strong policy message that also comes out of this year's Survey, as in earlier Surveys, is **the low importance of labour costs for deciding the location of R&D or production activities**, especially for companies from the low-tech sectors. Companies attach much more value to high availability of personnel and knowledge, access to (economically and politically stable) markets and proximity to other activities within the company. In combination with the fact that **market pull** is the most important driver for future R&D investments, this shows the importance of a healthy economy for attracting R&D and production activities.

Linking this with the Commission's structural reforms being currently pursued, companies in this Survey seem to consider reforms linked to **product market** (single markets, business investment) **and market regulations** (simplifying compliance with laws) having a potentially higher impact on increasing their R&D and innovation activities than reforms linked to the labour market.

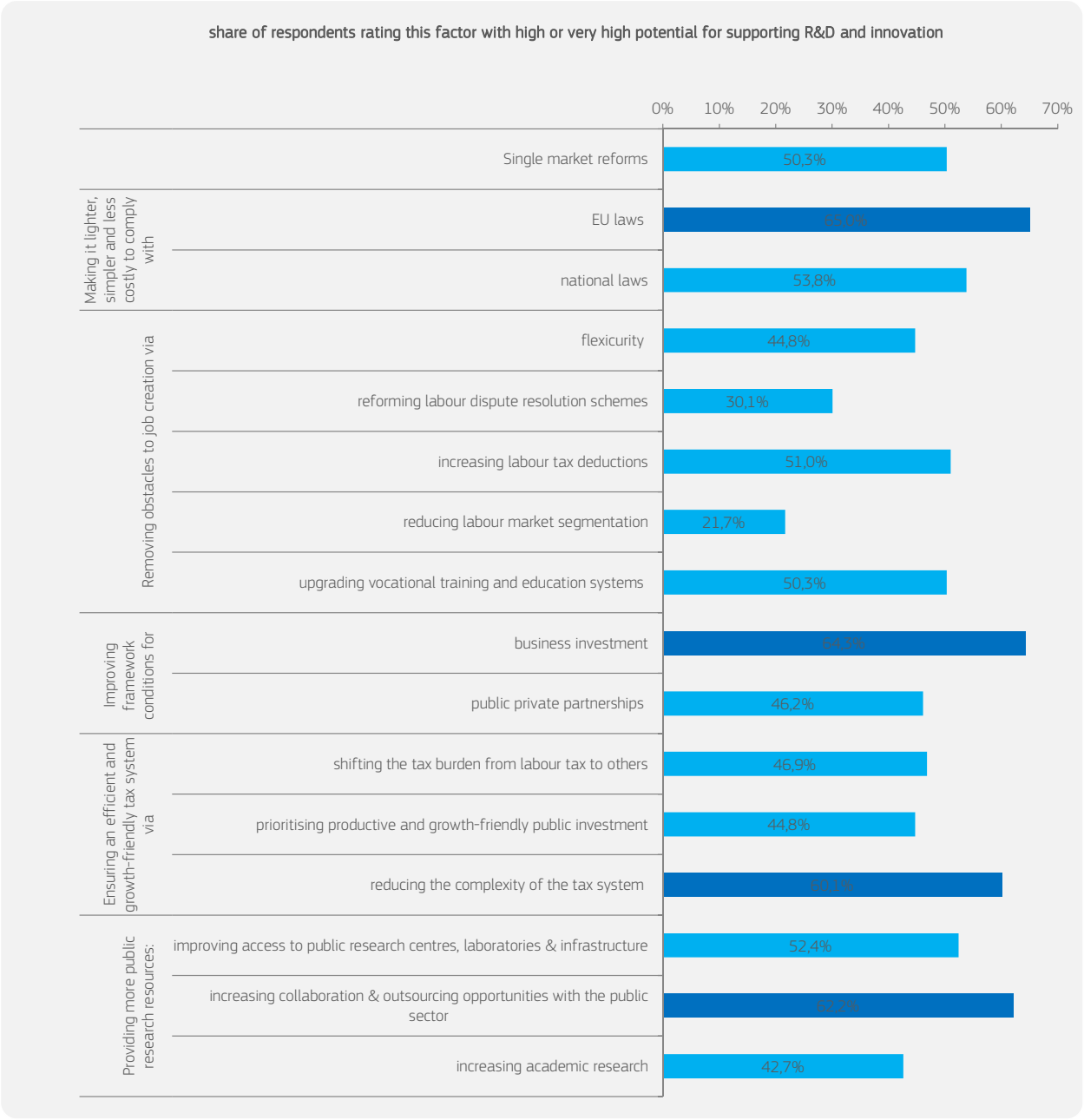


FIGURE 3 – R&D INVESTMENT EXPECTATIONS FOR THE NEXT TWO YEARS, P.A., IN REAL TERMS, BY WORLD REGION & SECTOR GROUP.

Note: The figure refers to 143 (49 high R&D intensity, 66 medium and 28 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2016)

1 INTRODUCTION

1 Introduction

Investment in research and innovation is one of the EU's highest policy priorities. Research and Technological Development policies were anchored in the Amsterdam Treaty as long ago as 1997, and research and innovation have become a mayor policy focus of the European Commission as a trigger of economic growth and job creation. Among President Juncker's top priorities, the «Investment Plan for Europe» has research and innovation investment as one of its main objectives to trigger funding and mobilise investment in the real economy[2]. Its European Fund for Strategic Investments (EFSI) has already raised EUR 116 billion in investments in its first year of operation and recently been extended and expanded in geographical scope to boost investments in Africa and EU Neighbourhood countries[3]. The policy initiatives also comprise the creation of an investment-friendly climate via the Digital Single Market, the Energy Union, the Capital Markets Union and the European Semester[4].

Regarding European research and innovation policy, Commissioner Moedas outlined the main goals maximising the contribution of existing[5] or renewed policies and programmes across EU policies: Open Innovation, Open Science and Open to the World[6].

The Industrial Research and Innovation Monitoring and Analysis II (IRIMA II) project[7] supports policymakers in these initiatives and monitors progress towards the 3% headline target. Getting a better understanding of the main determinants and barriers for research and innovation investments in Europe and of their impacts in terms of productivity, growth and employment will help policy makers to design and implement measures to support business R&D investments in Europe. Furthermore, improving the knowledge about the location of top R&D innovators' activities (including innovation, production and employment) is of particular relevance in the context of the assessment of Member States' (European Semester) and regions' (smart Specialisation) industrial innovation policies. IRIMA II therefore will continue to investigate the location of the research and innovation activities of main world industrial players and the factors behind companies' location decisions, to inform policy makers on the conditions and incentives needed to attract high-value and knowledge intensive activities to the European economy.

IRIMA II's core activity is the EU Industrial R&D Investment Scoreboard[8] which analyses private R&D investments based on the audited annual accounts of companies and shows ***ex-post*** trends. By collecting expectations and qualitative statements from the EU Scoreboard companies, the present survey complements the Scoreboard with ***ex-ante*** information and detailed company-level feedback on how R&D strategies are shaped.

In our surveys, 'R&D investment' is defined as the total amount of R&D financed by the company no matter

[2] See: http://ec.europa.eu/priorities/jobs-growth-and-investment/investment-plan_en

[3] See: State of the Union 2016: Strengthening European Investments for jobs and growth, http://europa.eu/rapid/press-release_IP-16-3002_en.htm

[4] See: http://ec.europa.eu/europe2020/making-it-happen/index_en.htm

[5] Such as Horizon 2020 see: https://ec.europa.eu/programmes/horizon2020/

[6] See: https://ec.europa.eu/research/openvision/index.cfm

[7] See: http://iri.jrc.ec.europa.eu/home /. The activity is undertaken jointly by the Directorate General for Research and Innovation (DG RTD.A; see: http://ec.europa.eu/research/index.cfm?lg=en) and the Joint Research Centre, Institute for Prospective Technological Studies (JRC-B; see: https://ec.europa.eu/jrc/en/science-area/innovation-and-growth).

[8] The Scoreboard is published annually and provides data and analysis on companies from the EU and abroad investing the largest sums in R&D (see: http://iri.jrc.ec.europa.eu/scoreboard.html).

where or by whom it was performed. This excludes R&D financed by governments or other companies, as well as the company's share of any associated company or joint venture R&D investment. It includes, however, research contracted out to other companies or public research organisations, such as universities. The survey reports what each responding company states as its actual financial commitment to R&D. This is different from the official statistical concept, business expenditure on R&D (BERD), which provides a geographical perspective[9].

The questionnaire was sent by post to the top operational level (chief executive officer or similar) or previous year's contact person of the 1 000 European companies that appear in the 2015 EU Industrial R&D Investment Scoreboard. In total, 157 responses were received, which is a response rate of 15.7%[10]. The response rate was similar to the previous year (16.2%).

The 157 participating companies state a total global R&D investment of € 59.3 billion for the financial year 2015, which corresponds to one third of the total R&D investment by the 1 000 EU Scoreboard companies. In Table 1 below, the number of responses received is compared with the R&D share of the 1 000 EU Scoreboard companies[11].

SECTOR GROUP	ICB SECTOR	NUMBER OF RESPONSES	R&D SHARE OF THE SAMPLE OF THE 1000 EU SCOREBOARD COMPANIES
High R&D intensity	Aerospace & Defence, Health C are Equipment & Services, Pharmaceuticals & Biotechnology, Software & Computer Services, Technology Hardware & Equipment	51	23%
Medium R&D intensity	Alternative Energy, Automobiles & Parts, Chemicals, Commercial Vehicles & Trucks, Electronic & Electrical Equipment, Financial Services, Fixed Line Telecommunications, Food Producers, General Industrials, Household Goods & Home Construction, Industrial Engineering, Industrial Machinery, Media, Oil Equipment, Services & Distribution, Personal Goods, Support Services	73	46%
Low R&D intensity	Banks, Construction & Materials, Electricity, Forestry & Paper, Gas, Water & Multi-utilities, Industrial Metals & Mining, Industrial Transportation, Mining, Oil & Gas Producers	33	18%
		157	**34%**

TABLE 1 – NUMBER OF RESPONSES, BY SECTOR GROUP
Source: European Commission JRC-B (2016)

Like previous years, companies in the medium R&D intensity sectors constitute the majority of respondents in the sample. As shown in Figure 4 below, the medium R&D intensity companies are also responsible for the majority of R&D investment among the survey sample and the 2015 Scoreboard.

[9] BERD includes R&D financed by the company itself, as well as R&D performed by a company but funded from other sources. Official BERD figures comprise R&D carried out by the companies physically located in a given country or region (including foreign-owned subsidiaries), regardless of the source of funding.

[10] See Annex A: The Methodology of the 2016 Survey.

[11] R&D intensity is the ratio between R&D investment and net sales. An individual company may invest a large overall amount in R&D but have a low R&D intensity if net sales are high (as is the case of many oil & gas producers, for example). For the sector groupings see: Annex A: The Methodology of the 2016 Survey.

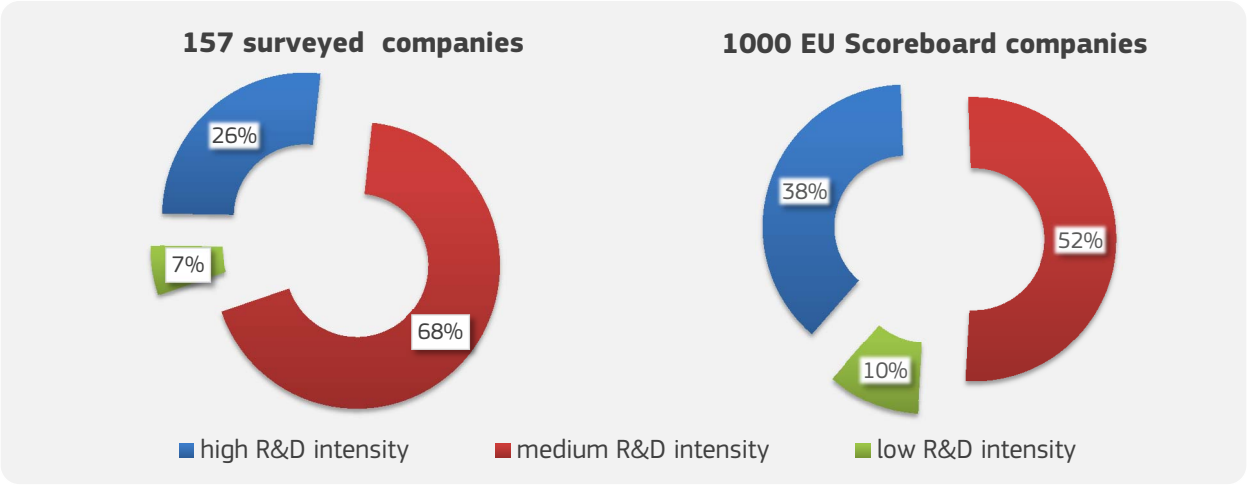


FIGURE 4 – DISTRIBUTION OF R&D INVESTMENT IN THE SURVEY COMPARED WITH THE 2015 SCOREBOARD

Note: The figure refers to all 157 companies in the sample representing one third of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2016)

Most of the companies participating in our survey are very large, having on average net sales of € 12 billion, 30 000 employees in total and 2 164 R&D employees. The sample contains only eight medium-sized companies and four small ones, most of which are in the high R&D intensity sectors (pharmaceuticals & biotechnology and health). Of the large companies in the sample, 12 had between 251 and 999 employees, 59 between 1 000 and 9 999 employees, 42 between 10 000 and 29 999 employees, and 32 more than 30 000 employees. The sample of our surveys containing mainly very large companies is very different from the Community Innovation Survey (CIS), which sample a much higher number of small and medium-sized firms[12].

The slightly smaller number of responses received corresponds to a slightly shorter response period compared to the previous edition. The response rate per day was similar than in the previous survey and 55% of previous participants responded[13].

This is our eleventh R&D investment survey since the 2005 pilot[14]. This year's questionnaire addresses the R&D investment expectations for 2016 & 17, R&D and production location strategies, R&D employment and the role of structural reforms for R&D. This last is closely linked to the Commission important reforms of the EU's economic governance rules[15]. Compared to last year's questionnaire, the technological content of R&D has been addressed with broader categories going beyond the previous focus on Key Enabling Technologies (KETs).

The survey always addresses the 1000 EU companies of the latest Scoreboard and because there is no obligation to participate, the numbers and sample composition of the responses vary over the years. The responding sample has always included a high proportion of medium R&D intensity companies as shown above. In case it occurs that the sample composition has an impact on the results or certain sectors of firms stand out this is mentioned in the analysis.

[12] The CIS uses stratified sampling for at least three size classes (small, medium and large enterprises) across all EU Member States.

[13] Out of the 157 responding companies, 87 had participated in the previous two surveys (in 2015, 106 out of 162), 67 in the previous three, and 51 in the previous surveys.

[14] See: http://iri.jrc.ec.europa.eu/survey.html

[15] See: "The 2015 Annual Growth Survey": http://ec.europa.eu/europe2020/pdf/2015/ags2015_en.pdf

2

R&D INVESTMENT **EXPECTATIONS**

2 R&D Investment Expectations

The companies that participated in the survey expect R&D investment to increase by average 1.4% in the two years 2016–17[16]. This is only half of our previous survey (3.0%) and mainly due to the lack of R&D investment growth expectations of a few very large companies in the automobiles & parts sector. Without this, the expected R&D investment growth of the sample would be 3.8% and thus slightly higher than in the previous survey.

The expected 1.4% annual growth in corporate R&D investment including the automobiles & parts sector is quite similar to the nominal EU growth estimates for gross domestic product (GDP) of 1.6% for 2016 and 1.8% for 2017[17], and the 3.8% expected growth without the automobiles & parts companies would be considerably higher. However, in both cases, R&D investment expectations are still far from the levels reported prior to the economic crisis that started in 2008 (7% in the 2007 survey).

The highest expectations for R&D investment growth come from companies in the high R&D intensity sectors (6.2%), followed by the low (3.5%) and the medium R&D intensity ones (-0.2% overall or +1.2% excluding automobiles & parts; see Figure 5 below). Compared to last year's survey, expected growth rates increased in the high and low R&D intensity sectors (6.2% current vs past year's 3.6% and 3.7% current vs past year's 2.6%, respectively) while it is much lower for the medium R&D intensity ones (-0.2% current vs past year's 3.0%).

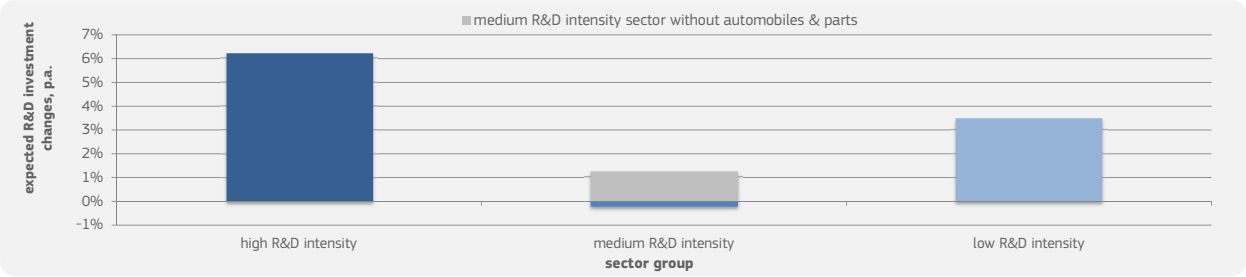


FIGURE 5 – EXPECTED NOMINAL CHANGES IN R&D INVESTMENT IN THE NEXT COUPLE OF YEARS, PER ANNUM

Note: The figure refers to 133 out of the 157 companies in the sample, weighted by R&D investment, representing 29% of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2016)

Figure 6 shows how the expected changes in R&D investment for the next couple of years (2015–17) compare to those of our two previous surveys[18]. Compared to last year, expectations have slipped in 12 out of the 15 sectors with at least five responses.

[16] The expectations are per annum over the next two years, weighted by R&D investment.

[17] European Commission, "Spring 2016 economic forecast" (see: http://ec.europa.eu/economy_finance/publications/eeip/pdf/ip025_en.pdf).

[18] The samples in the different surveys have different compositions.

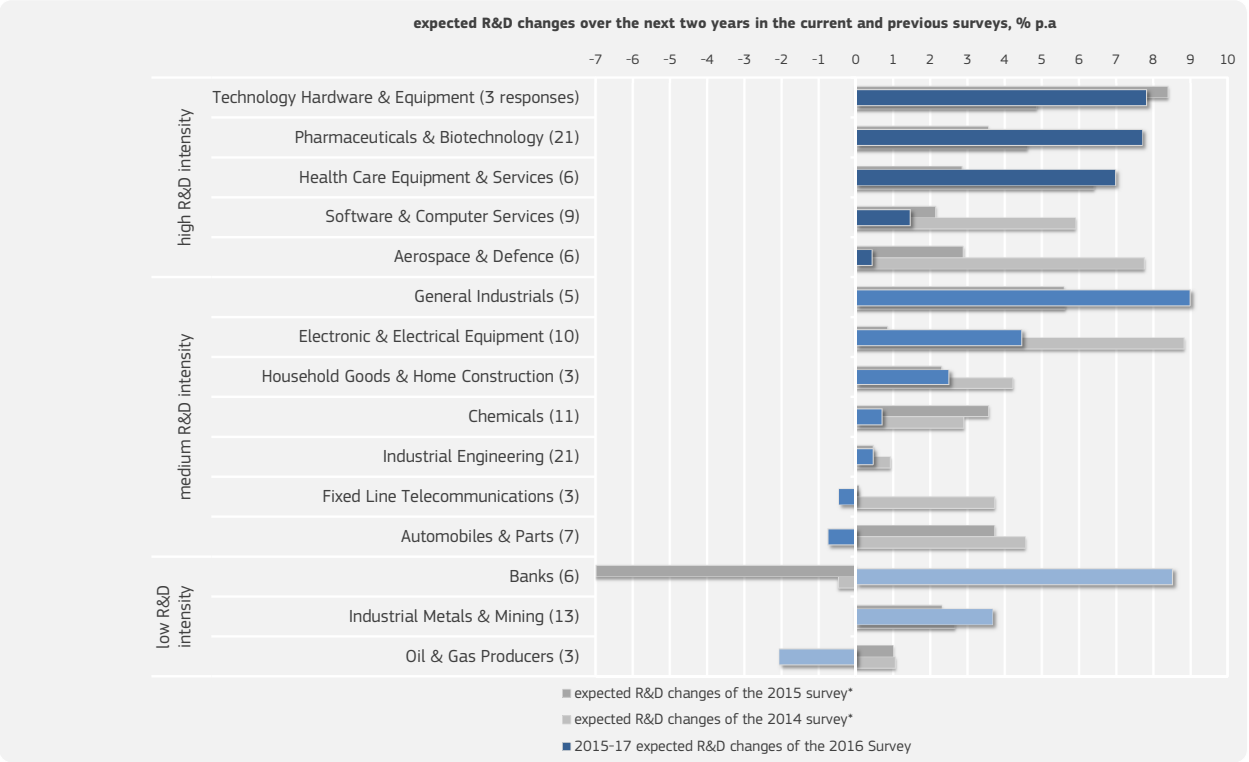


FIGURE 6 – EXPECTED CHANGES IN ANNUAL R&D INVESTMENT IN THE CURRENT AND THE TWO PREVIOUS SURVEYS, P.A

Note: * The sample compositions in the surveys vary from year to year.

p.a. per annum

Growth rates calculated as CAGR over the years for which expectations were mentioned (see Annex A: The Methodology of the 2016 Survey). The figure refers to 117 out of the 157 companies in the sample, weighted by R&D investment, representing 29% of the total R&D investment by the 1000 EU Scoreboard companies. Only for sectors with at least three responses.

.Source: European Commission JRC-B (2016)

In the high R&D intensity sectors, pharmaceuticals & biotechnology and health care equipment & services companies expect a much higher R&D investment growth than in the previous year (7.8% and 7.0%, respectively), whereas expectations remain similar in technology hardware & equipment (7.8%) and lower than in the past year in software & computer services and aerospace & defence (1.5% and 0.4%, respectively).

In the medium R&D intensity sectors, the expectations for R&D investment growth of the automobiles & parts companies have dropped from +3.7% in the previous year to -0.8% in the current edition. This has a considerable impact on the overall sample average because these companies contribute half of the total sample R&D. In this group of sectors, the expectations of chemicals and fixed line telecommunications companies also decreased from the previous year (0.7% and -0.5%, respectively), while they increased for general industrials and electronic & electrical equipment (9% and 4.5%, respectively).

In the low R&D intensity sectors, banks R&D expectations increased drastically (from -7% previously to +8.5% in the current survey) but have a low weight for the whole sample. For companies in electricity and industrial metals & mining, expectations remained at similar levels to the past (around 4% each) while they decreased for oil & gas producers (from +1% previously to -2.1% in the current survey).

The figures of the US-based Industrial Research Institute for global R&D investment growth in the EU and the US are reported to be in the 2-3% range for 2016[19]. This is thus similar to the range projected here for EU-based companies (1.4% with and 3.8% without the automobiles & parts sector).

[19] 'The Industrial Research Institute's 2016 R&D Trends Forecast', Research-Technology Management, January–February 2016 (see http://www.tandfonline.com/doi/abs/10.1080/08956308.2016.1117319?journalCode=urtm20).

The R&D investment growth expectations collected in our surveys are c*ompared with the R&D investment trends observed in the 1000 EU Scoreboard companies in Figure 7.*

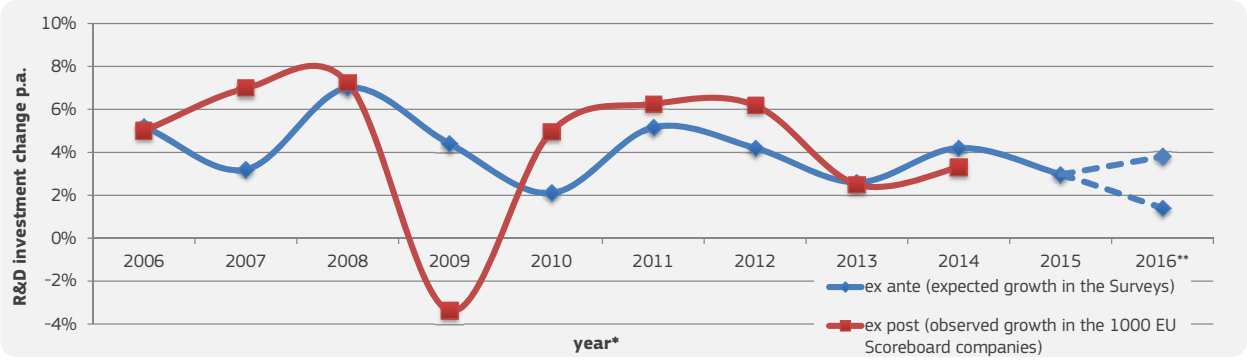


FIGURE 7 – EXPECTED (SURVEYS) VERSUS OBSERVED (SCOREBOARDS) R&D INVESTMENT CHANGES

Note: * For the Scoreboard referring to the financial year of the latest annual accounts, while Survey growth expectations are for the three calendar years following the exercise. The numbers are weighted by R&D investment and the samples of every year of the Scoreboard and Survey exercises vary in composition.

** expectations as of the current Survey 1.4% for all sectors and 3.8% without the automobiles & parts sector

Source: European Commission JRC-B (2016)

The figure compares the different Survey and Scoreboard exercises and thus contains samples that not only differ in size[20] but also in their sectoral composition. In addition, there is around 1.5 year delay between ex post audited figures in the Scoreboards and ex ante expectations in the Surveys. Figures of the 1000 EU Scoreboard companies generally follow the trend expected by the Survey respondents. The expected growth rates of the Surveys for the years 2013 and 2014 were very close to the ex-post trends observed for the 1000 EU Scoreboard companies.

For the 126 out of the current Survey sample of 157 companies there is information for the past nine years on R&D, net sales and operating profit. Figure 8 below compares the R&D, net sales and operating profit trends as observed in the latest Scoreboard and combines them with the R&D expectations in the present Survey for 2106 onwards.

FIGURE 8 – MAIN OBSERVED SCOREBOARD FIGURES OF THE COMPANIES IN THE SAMPLE

Note: * For the Scoreboard referring to the financial year of the latest annual accounts. For to 126 (40 high R&D intensity, 56 medium and 40 low) out of the 157 EU companies in the sample weighted by R&D investment, representing 30% of the total R&D investment by the 1000 EU R&D Scoreboard companies.

** expectations as of the current Survey 1.4% for all sectors and 3.8% without the automobiles & parts sector

Source: European Commission JRC-B (2016)

The ex post trends of the R&D investment in the sample (Figure 8) and the previous Scoreboards (Figure 7) follow a similar pattern. The net sales and operating profit trends seem similar to the R&D trends, but are somewhat more pronounced. Although the companies in the sample experienced negative net sales and operating profit growth in 2013, the trends foreseen by the Survey point to a stable R&D investment growth from 2013 onwards. This is somewhat lower than the level of the periods between 2010 & 2012 and before 2008.

The three sectors with the biggest R&D investment in the sample, automobiles & parts, technology hardware & equipment and pharmaceuticals & biotechnology, constitute two thirds of the sample's R&D investment. This has been similar to our previous surveys where these three sectors together constitute at least around half of the total sample R&D. Figure 9 shows these expectations and compares them to those of the whole sample of each survey edition.

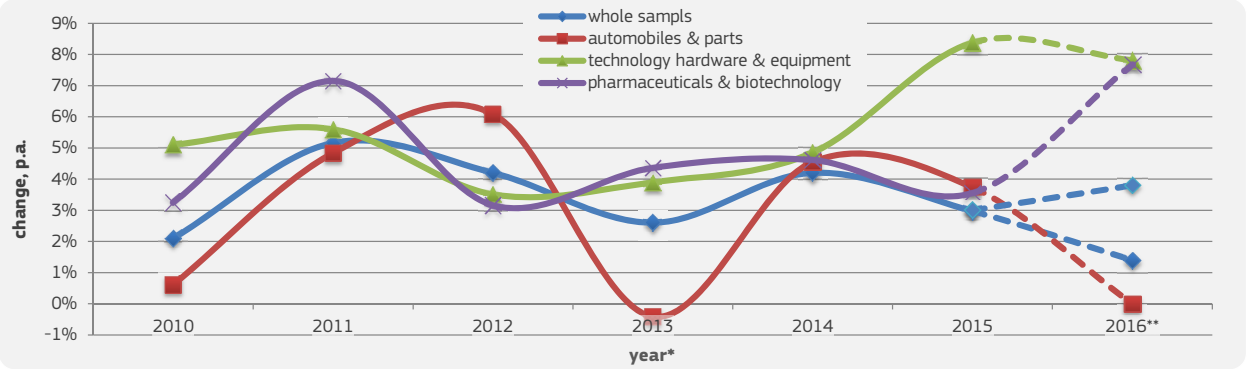


FIGURE 9 – EXPECTED R&D INVESTMENT CHANGES OF THE COMPANIES OF THE THREE MAIN SECTORS IN THE SAMPLE OF EACH SURVEY

Note: The figure refers to the companies of each survey, for 2016 the 27 out of the 157 companies in the sample, weighted by R&D investment, representing 14% of the total R&D investment by the 1000 EU Scoreboard companies.

* years referring to the Survey year with expectations for the following years

** expectations as of the current Survey 1.4% for all sectors and 3.8% without the automobiles & parts sector

Source: European Commission JRC-B (2016)

The figure shows how the expectations of the companies from the different sectors fluctuate around those from the whole sample. In the present and the 2013 survey, those from automobiles & parts companies were especially low. This is only partially compensated for by the healthy expectations from the other two sectors.

[20] The EU Scoreboard contains 1 000 companies of which 15 to 20% participated in the annual Surveys.

3 TYPE OF R&D **UNDERTAKEN**

3 Type of R&D Undertaken

The participants were requested to state how much of their R&D investment for the financial year 2015 falling into each of seven categories of R&D investment types. Figure 10 below shows that, on average, the one with the highest R&D share is technology development (whether patented or not), followed by development for market launch (50% of R&D on average and 19%, respectively).

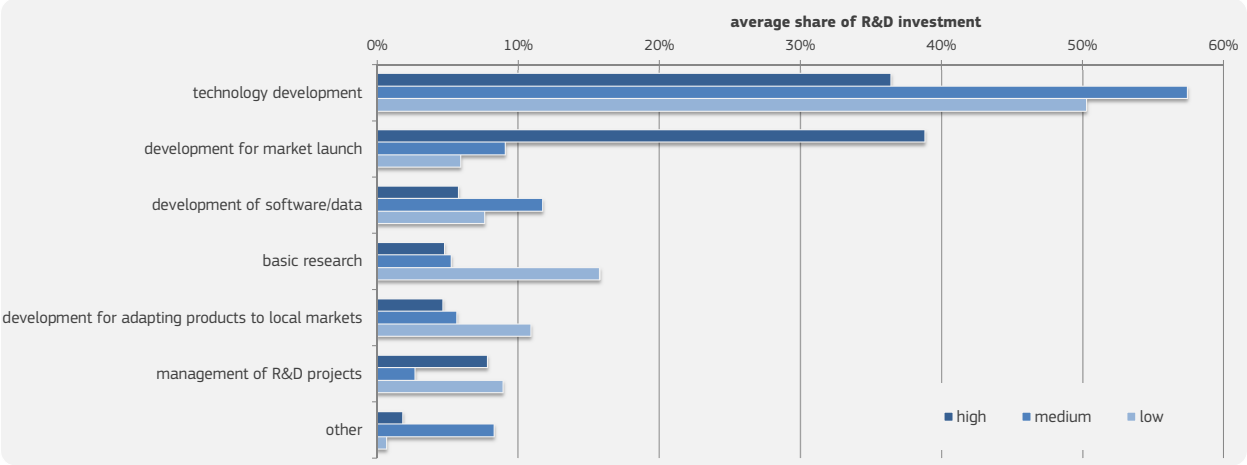


FIGURE 10 – SHARE OF INVESTMENT PER R&D TYPE

Note: The figure refers to 130 (43 high, 60 medium and 27 low R&D intensity) out of the 157 companies in the sample, weighted by R&D investment, representing 23% of the total R&D investment by the 1000 EU Scoreboard companies..

.Source: European Commission JRC-B (2016)

There are however important differences by sector group. Technology development (whether patented or not) takes up 50% or more of R&D for the medium and low R&D intensity companies, compared with 36% for the high R&D intensity ones. These last devote 38% to development for market launch, compared with less than 10% in the medium and low R&D intensity ones. The main reason for this is the high proportion of R&D for market launch declared by companies from the pharmaceuticals & biotechnology sector where this type of R&D is necessary to comply with regulatory requirements in order to obtain market access. Basic research has a relatively high share in the R&D budget of low R&D intensity companies mainly from industrial metals & mining companies.

The three sectors with the biggest R&D investment in the sample, automobiles & parts, technology hardware & equipment and pharmaceuticals & biotechnology, account for two thirds of the sample's R&D investment. It is therefore interesting to know in which type of R&D they are focused. Figure 11 below details the proportions of investment spent on the different R&D types. It shows that the profile of R&D activities in the automobiles & parts sector is similar to that of technology hardware & equipment companies, while that of pharmaceuticals & biotechnology companies is very different. The automobiles & parts companies spend almost 80% in technology development, followed by 10% in software development. The technology hardware & equipment

companies also have a high proportion of technology development (55%) but spend 10% in management on R&D projects and not in software development. The profile from the pharmaceuticals & biotechnology companies is much different. They spend almost 60% of their R&D for market launch (which presumably includes the very costly clinical testing and regulatory approval activities), and 20% in technology development.

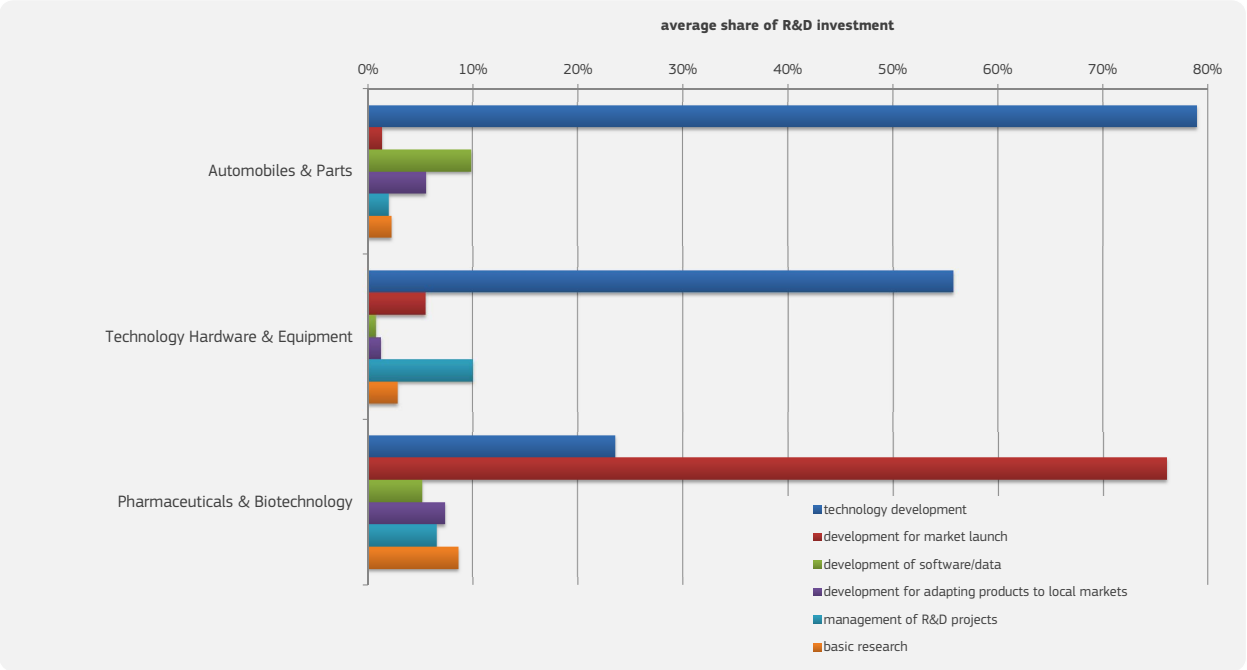


FIGURE 11 – SHARE OF INVESTMENT PER R&D TYPE FOR THE THREE BIGGEST SECTORS

Note: The figure refers to 27 out of the 157 companies in the sample, weighted by R&D investment, representing 14% of the total R&D investment by the 1000 EU Scoreboard companies.

.Source: European Commission JRC-B (2016)

While the above figures displays the proportions of investment in each R&D type, the following Table 2 reveals the total amounts and which four sectors account for the majority of the investment in each R&D type.

R&D TYPE	MAIN SECTORS	R&D INVESTMENT	(€ MILLION)
Technology development	total		19.626
	4 biggest sectors	Automobiles & parts	11.090
		Technology hardware & equipment	3.347
		Pharmaceuticals & biotechnology	1.086
		Chemicals	768
Development for market launch	total		7.662
	4 biggest sectors	Pharmaceuticals & biotechnology	3.501
		Aerospace & defence	1.036
		Personal goods	473
		Healthcare equipment & services	440
Development of software/data	total		3.713
	4 biggest sectors	Automobiles & parts	1.383
		Fixed line telecommunications	1.093
		Software & computer services	431
		Pharmaceuticals & biotechnology	238
Basic research	total		2.266
	4 biggest sectors	Pharmaceuticals & biotechnology	399
		Automobiles & parts	322
		Fixed line telecommunications	239
		Personal goods	226
Development for adapting products to local markets	total		2.225
	4 biggest sectors	Automobiles & parts	781
		Pharmaceuticals & biotechnology	338
		Industrial metals & mining	147
		Chemicals	130
Management of R&D projects	total		1.926
	4 biggest sectors	Technology hardware & equipment	602
		Automobiles & parts	279
		Pharmaceuticals & biotechnology	304
		Fixed line telecommunications	140

TABLE 2 – SECTOR SHARE OF R&D TYPE OF THE FOUR MAIN SECTORS

Note: The table is based on data from 130 (43 high, 60 medium and 27 low R&D intensity) out of the 157 companies in the sample, weighted by R&D investment, representing 23% of the total R&D investment by the 1000 EU Scoreboard companies

Source: European Commission JRC-B (2016)

As regards investment according to R&D type, a single sector, the automobiles & parts sector is responsible for a very high proportion of the R&D (57%) technology development (whether patented or not). Similarly, the pharmaceuticals & biotechnology sector accounts for a large proportion of R&D investment for development for market launch activities (46%).

Investment in other R&D types is not dominated by a single sector. When it comes to investment in development of software & data, the two sectors automobiles & parts and fixed line telecommunications companies account for the majority of R&D. Likewise, half of the investment in development for adapting products to local markets again comes from two sectors, in this case, automobiles & parts and pharmaceuticals & biotechnology. For the management of R&D projects, the two sectors are technology hardware & equipment, automobiles & parts and pharmaceuticals & biotechnology.

Basic research is rather evenly distributed among pharmaceuticals & biotechnology, automobiles & parts, fixed line telecommunications and personal goods.

4 DRIVERS OF **CHANGES IN R&D**

4 Drivers of Changes in R&D

For the expected changes to R&D investment addressed in the previous section, the respondents were asked to state the relevance of a number of drivers. The companies were asked to rate on a scale from 1 (irrelevant) to 5 (highly relevant) the importance of a series of drivers for their expected R&D change. For each of the drivers included in the survey, Figure 12 below shows the percentage of companies that consider them very (4) or highly (5) relevant.

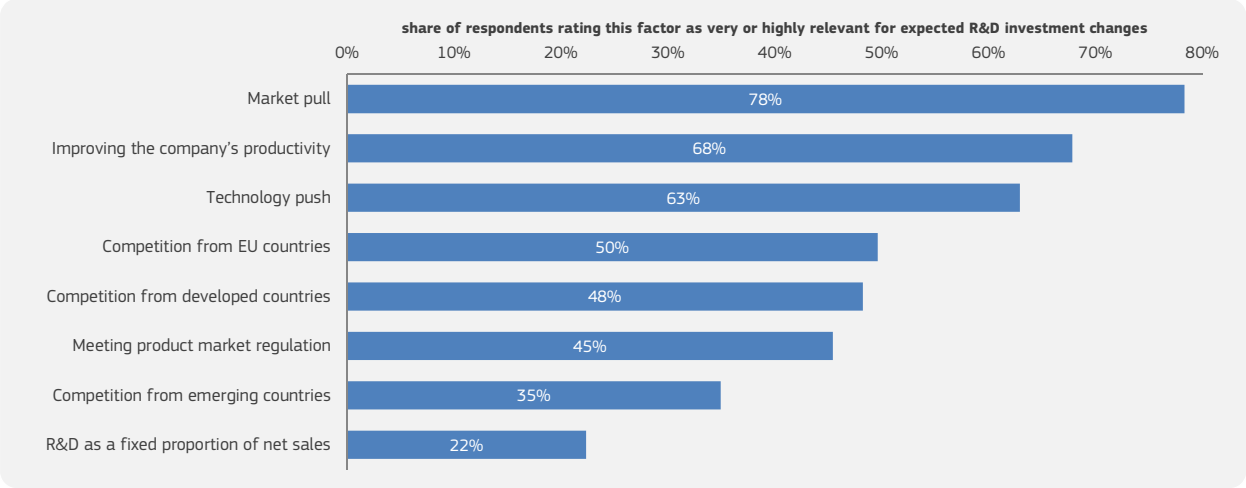


FIGURE 12 – DRIVERS OF EXPECTED R&D INVESTMENT CHANGES

Note: The activities are listed by average relevance of the major items in the survey. The figure refers to 143 out of the 157 companies in the sample (47 high, 66 medium and 28 low R&D intensity) representing 32% of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2016)

What drives the expected R&D investment changes of our companies seems to be mainly related to demand (market pull), followed by the attempt to improve the company's productivity and the chance to exploit technological opportunities (technology push). The importance of market pull and technology push for R&D expectations has also been observed in our previous surveys. Internal competition (i.e. from other EU companies) and competition from companies located in other developed countries are indicated as more important in motivating R&D investment than competition challenges coming from companies located in emerging countries. Meeting product market regulation is deemed as a very/high relevant driver of R&D investment by less than 50% of the respondents, while maintaining R&D as a fixed proportion of net sales is not indicated as a relevant motivation to invest in R&D.

The pattern described above does not change much when the replies are disaggregated according to sector R&D intensity. Figure 13 shows that what is relevant to companies operating in high R&D intensity sectors is also relevant for companies in medium and Low R&D intensity sectors – and vice versa. However, two exceptions to this general trend can be noted. A significantly higher

percentage of companies operating in low R&D intensity sectors than in the other two groups stating that improving the company's productivity and meeting product market regulation were very or highly relevant drivers of their R&D investment. This is due to the responses from the mining and oil companies in the low R&D intensity group.

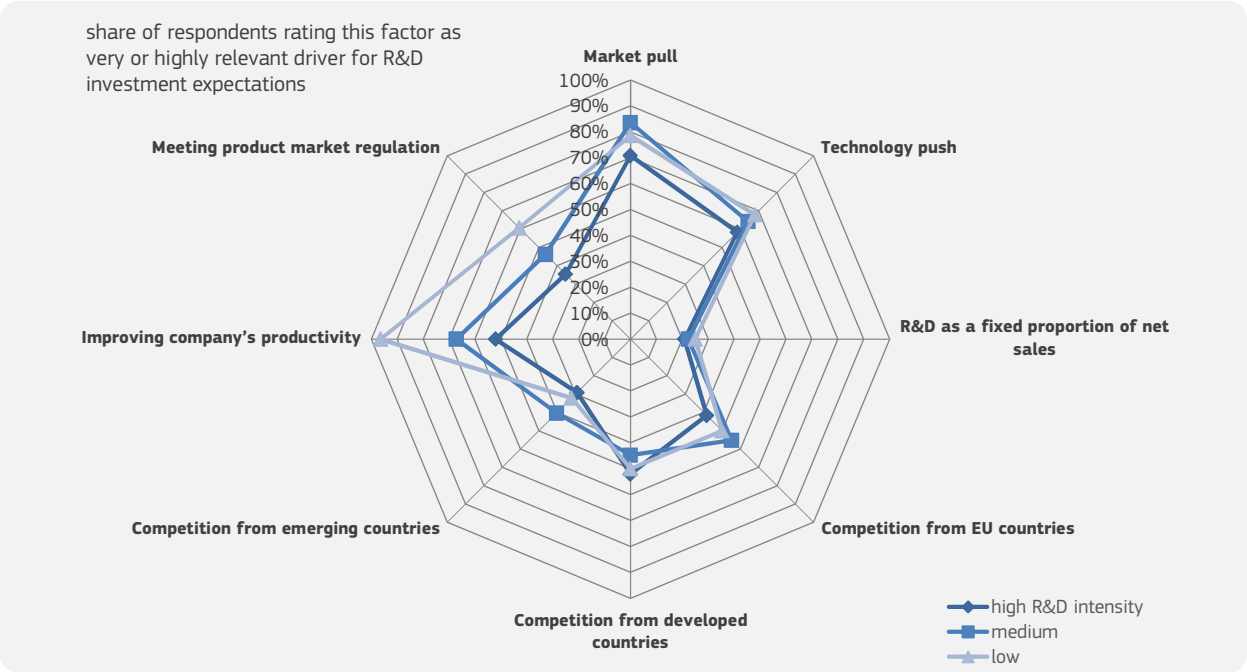


FIGURE 13 – DRIVERS FOR EXPECTED R&D INVESTMENT CHANGES - DETAIL

Note: The activities are listed by average relevance of the major items in the survey. The figure refers to 143 out of the 157 companies in the sample (47 high, 66 medium and 28 low R&D intensity) representing 32% of the total R&D investment by the 1000 EU Scoreboard companies.

.Source: European Commission JRC-B (2016)

Because it would be interesting to see if what drives a company's decision to increase its R&D investment differs from what motivates another company to decrease it, the sample of respondents was split into two groups. One contains 96 companies that expect an R&D investment increase over the next two years and the other 31 firms expecting their investment not to grow or even decrease in that period. For each group, Figure 14 reveals the percentage of companies indicating as very or highly relevant the drivers listed with respect to their planned R&D investment.

The comparison between the two groups can provide a first descriptive insight into what drives R&D investment decisions and what restrains them. With the notable exception of technology push as a driver, what companies perceive as important (or not) in orienting their decision to invest in R&D is also significant (or not) for their choice not to do it. This makes sense considering what drives an R&D investment can also be what prevents it, depending on the circumstances. For example, market factors perceived as favourable to the company can push it to invest in R&D, while adverse market conditions can result in postponing the decision to increase R&D investment or even prompt a decision to decrease it. The same is true of competition with other companies, which can be an incentive to invest (in order to keep their pace or overtake them) or a disincentive (if fierce competition makes the possible gains from an investment in R&D more uncertain).

It is also understandable why, when it comes to exploiting technological opportunities, the percentage of companies valuing this driver as important is much higher among those planning an increase in R&D than those that are not. It would be counter intuitive to decrease your R&D investment when one wants to explore or take advantage of new technological opportunities.

Complying with product market regulations seems more a push factor to invest rather than a reason not to invest

in R&D. The difference can be explained by the pattern observed above regarding firms belonging to low R&D intensity sectors. Mining and oil companies can in fact invest much of their R&D in trying to meet increasingly demanding product market standards, especially of the environmental type.

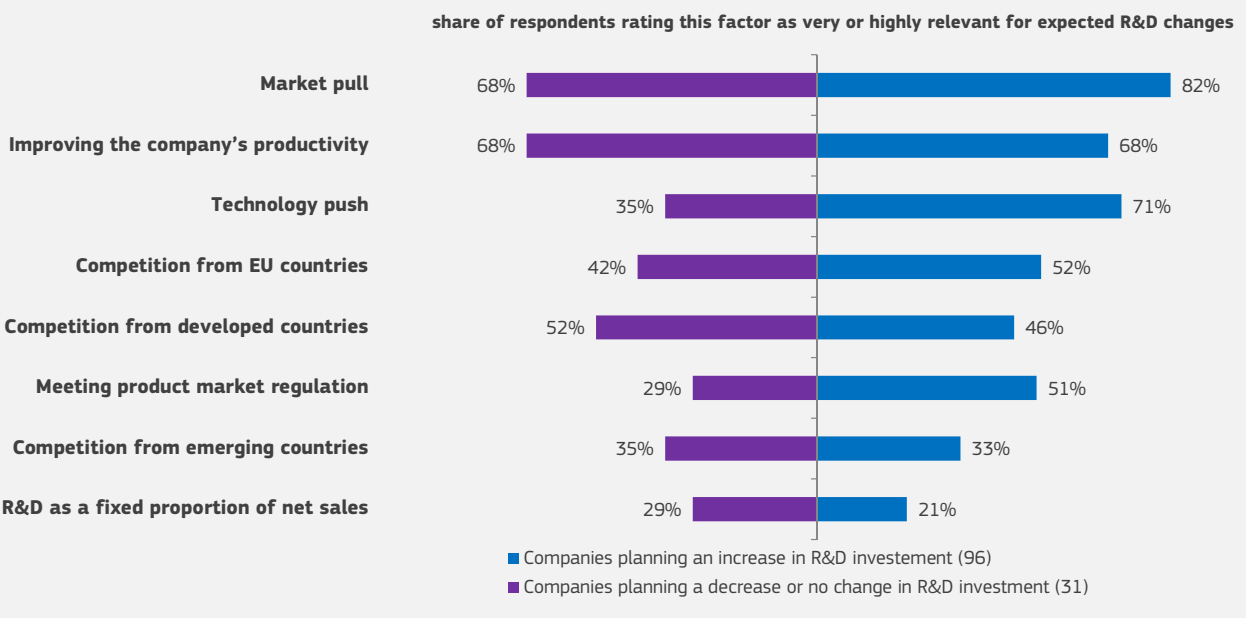
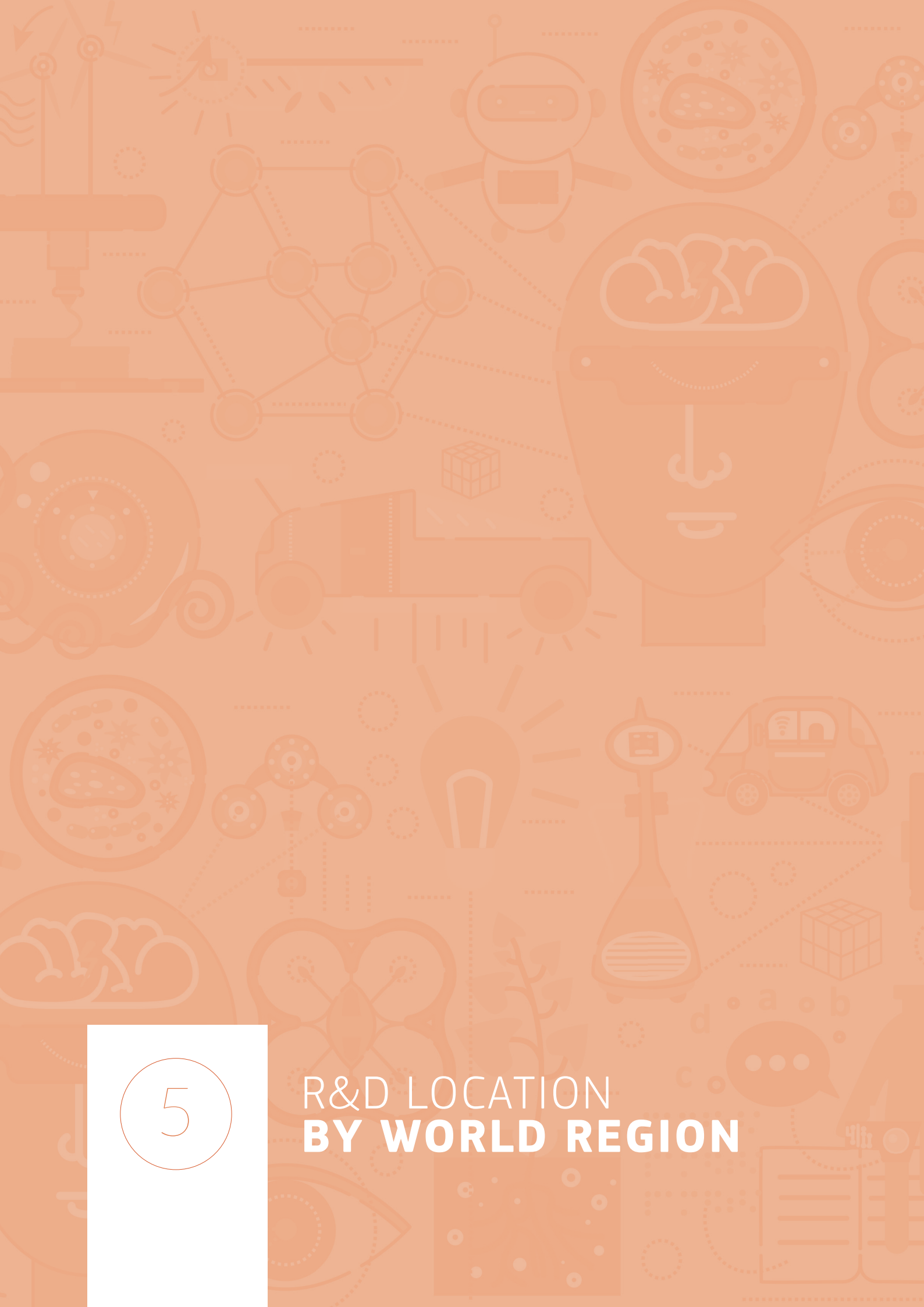


FIGURE 14 – DRIVERS FOR EXPECTED R&D INVESTMENT IN – PLANNED R&D INCREASE VS PLANNED R&D DECREASE OR NO CHANGE

Note: The activities are listed by average relevance of the major items in the survey. The figure refers to 127 out of the 157 companies in the sample (those that replied to both questions 6 and 7).

Source: European Commission JRC-B (2016)



5 R&D LOCATION **BY WORLD REGION**

5 R&D Location by world region

The scope of questions addressing the location of R&D has been broadened in the present exercise. As is evident from the sample description, the participating companies are rather large and therefore highly internationalised. This year's questionnaire addresses not only the location of R&D investment as in previous surveys, but also the number of the number of R&D employees and in how many countries they are located.

5.1 | R&D employee location

As shown in the next Figure 15, the average number of R&D employees varies largely by sector group. The highest average number of R&D employees is in the medium R&D intensity sector: approximately 3800 per company, followed by the high and low R&D intensity sectors (approximately 1750 and 510, respectively). The high average for the medium R&D intensity sector is mainly due to the very high numbers of R&D employees in the automobiles & parts sector (more than 23 000 per responding company). This correlates with the fact that these employees are located in 40 countries on average, whereas most of the other companies have on average 5 to 12 R&D sites.

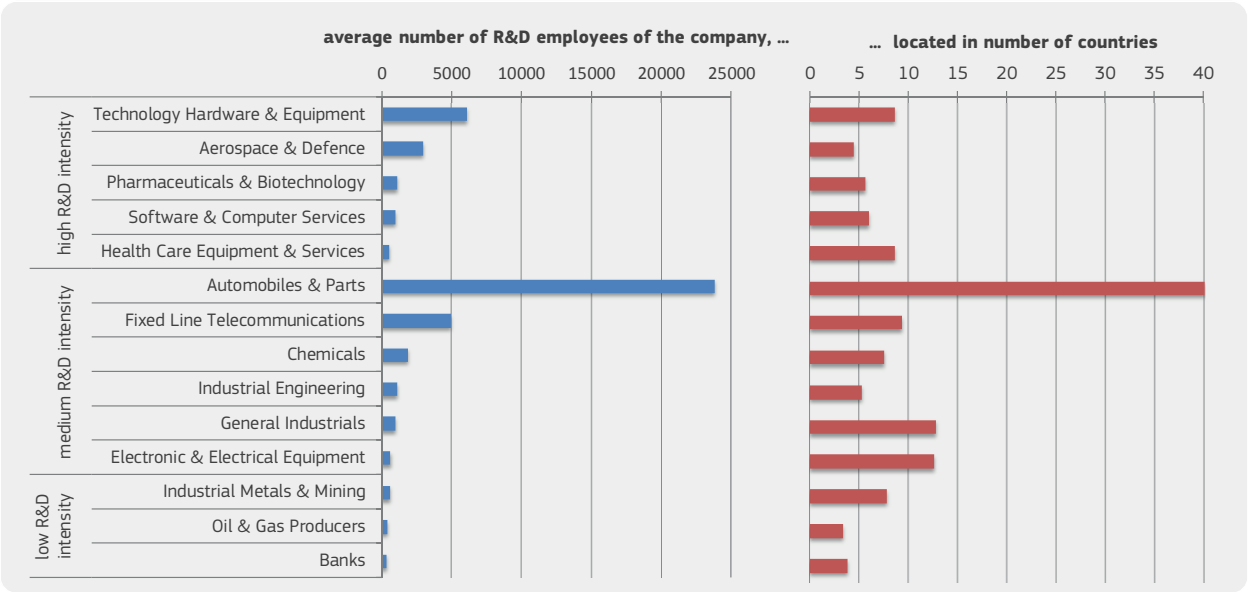


FIGURE 15 – AVERAGE NUMBER OF R&D EMPLOYEES PER COMPANY AND NUMBER OF COUNTRIES WHERE THEY ARE LOCATED

Note: The figure refers to 127 (51 high R&D intensity, 57 medium and 20 low) out of the 157 EU companies in the sample representing 30% of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2016)

Further information on the country location of R&D and production sites can be found in section 6 Location and attractiveness for R&D and production below.

In order to address the relationship between R&D investment and R&D employees, Figure 16 compares the proportion of R&D employees to the total number of employees with the share of R&D investment in total net sales. The highest proportions of R&D employees in total employees are found in the high R&D intensity sectors.

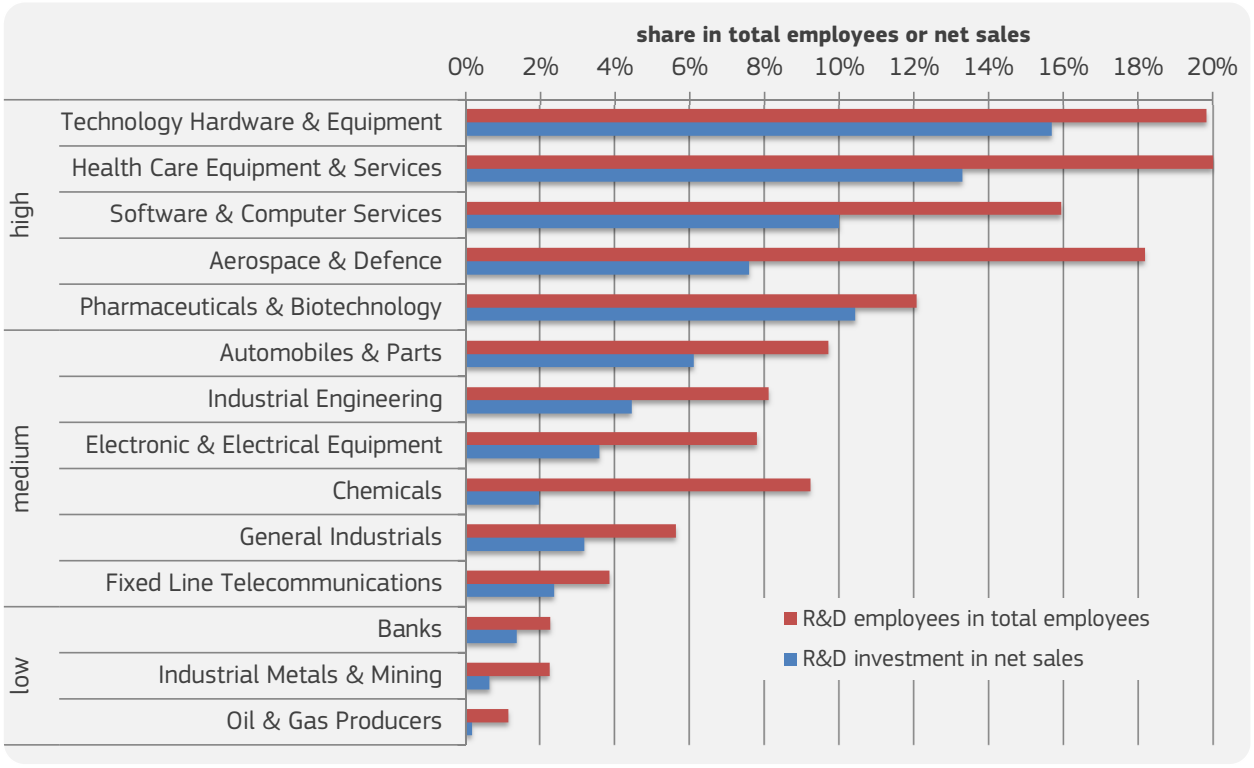


FIGURE 16 – SHARE OF R&D EMPLOYEES IN TOTAL EMPLOYEES AND R&D INVESTMENT IN NET SALES

Note: The figure refers to 127 (51 high R&D intensity, 57 medium and 20 low) out of the 157 EU companies in the sample representing 30% of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2016)

This reflects the fact that much of R&D investment is staff cost. The statistical correlation between the numbers of R&D employees and total employees is 90% in the high and medium R&D intensity companies and 70% for the low R&D intensity companies.

A few sectors have an especially high proportion of R&D employees to the total compared to the ratio of R&D investment in net sales. This may eventually be explained by the activities where highly specialised technical activities go in-hand with development or laboratory activities falling under R&D (aerospace & defence, chemicals, oil & gas producers).

The above underlines the importance of R&D as a generator of jobs for highly skilled workers. In the current survey sample, in which a number of very large players participated, the automobiles & parts sector stands out as a provider of R&D employment in the EU.

5.2 | Location of R&D investment

R&D investment location by world region is further broken down by both the current distribution (stock) of R&D investment and the distribution of the expected changes in R&D investment (dynamics). The current distribution in terms of proportions of total R&D investment in each of the seven world regions is displayed in Figure 17 below.

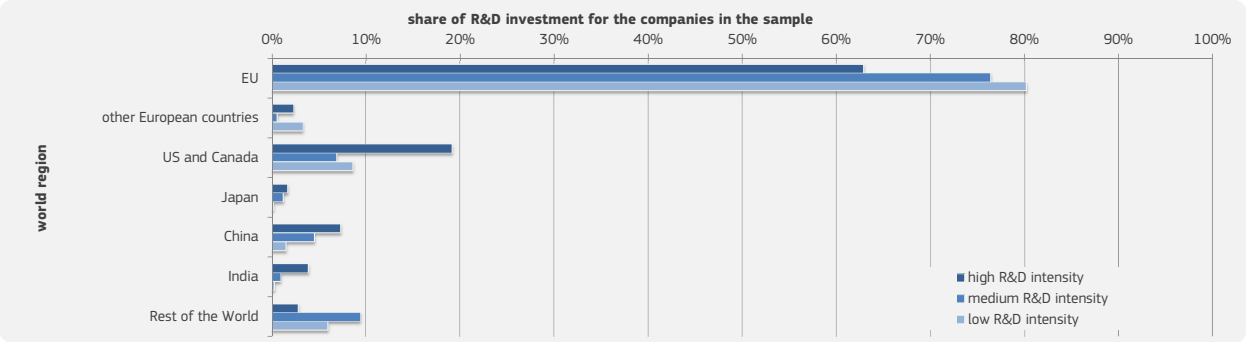


FIGURE 17 – DISTRIBUTION OF R&D INVESTMENT BY WORLD REGION AND SECTOR GROUP

Note: The figure refers to 141 (48 high R&D intensity, 64 medium and 29 low) out of the 157 EU companies in the sample, weighted by R&D investment, representing 32% of the total R&D investment by the 1000 EU Scoreboard companies. Other EU countries include Switzerland, Norway and others, while the rest of the world includes a heterogeneous set of countries such as South Korea, Taiwan, and Brazil. See also Annex B: Questionnaire question D.8 R&D location strategy. .

.Source: European Commission JRC-B (2016)

Very like last year's survey, the EU-based companies in the sample carry out a quarter of their R&D outside the EU (27%). Around 10% of R&D investment outside the EU is in the United States and Canada, followed by the rest of the world (7%), China (5%), India (2%), other European countries and Japan (around 1.5% each).

Another finding that differs little from previous surveys is that the European companies surveyed continue to invest only a small proportion of R&D in China and India (overall around 8% for the two countries combined). The proportion of R&D by EU companies invested in these countries is slowly increasing, but remains relatively low considering that those countries' account for a rising share of global production and GDP.

Compared with last year's survey, the high R&D intensity companies are more internationalised. That is because of the sample composition has changed. A bigger proportion of high R&D intensity companies in the current sample is in health-related sectors (pharmaceuticals & biotechnology and healthcare equipment & services) with almost 40% of R&D outside the EU, half of which in the US and Canada. It has been observed over many survey editions that the proportion of R&D invested outside the EU by health-related companies is about twice the sample average, because of the high importance of the US health market and its regulatory requirements for product approval.

Figure 18 below break down the overall average expectations for R&D investment. It reveals the picture in the different world regions and by sector group. Figures for the medium R&D intensity sectors are shown both with and without automobiles & parts because of that sector's weight on the overall average.

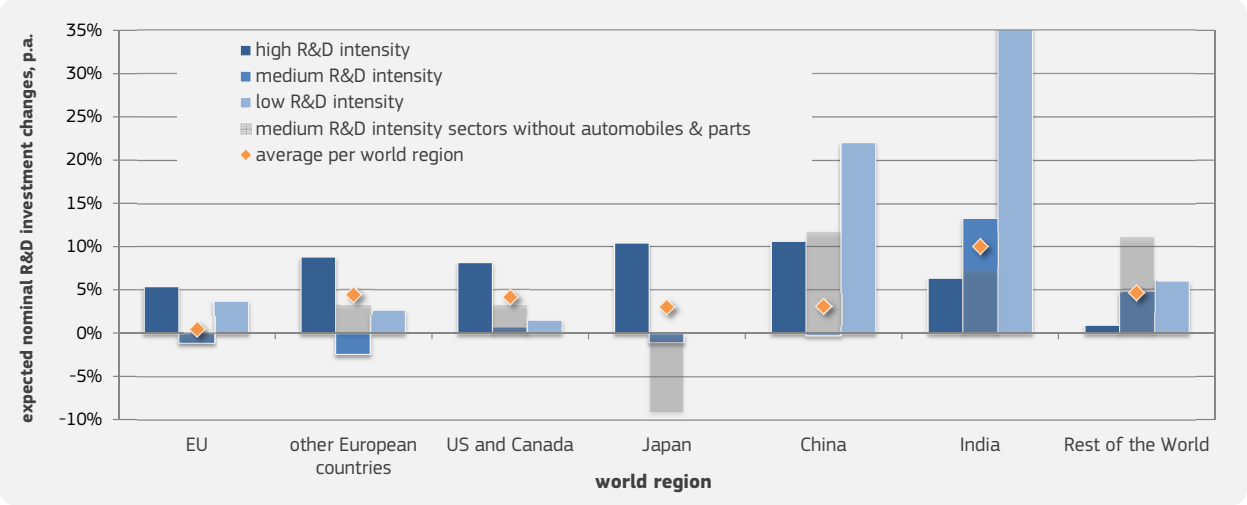


FIGURE 18 – EXPECTED ANNUAL CHANGES IN R&D INVESTMENT IN THE NEXT TWO YEARS, PER ANNUM, IN REAL TERMS, BY WORLD REGION AND SECTOR GROUP

Note: The figure refers to 122 (40 high R&D intensity, 56 medium and 26 low) out of the 157 EU companies in the sample, weighted by R&D investment and after elimination of outliers, representing 30% of the total R&D investment by the 1000 EU Scoreboard companies. Other EU countries include Switzerland, Norway and others, while the rest of the world includes a heterogeneous set of countries such as South Korea, Taiwan, and Brazil. See also Annex B: Questionnaire question D.8 R&D location strategy.

.Source: European Commission JRC-B (2016)

Much higher growth is expected in the non-EU world regions: India (10%); the rest of the world (4.6%), other European countries (4.5%), the United States and Canada (4.2%); China (3.1%) and Japan (3%). Expected growth for China was in the double-digits in our previous surveys. It has suffered from shrinkage in the automobiles & parts sector. Without the companies from the automobiles & parts sector, the expectations for China would be 8 percentage points higher (11.5%) as well as 2 percentage points higher for all the other world regions.

The sectors driving the increases in China and India are pharmaceuticals & biotechnology and healthcare equipment & services (both high R&D intensity), chemicals (medium R&D intensity) and industrial metals & mining (low R&D intensity),

The medium R&D intensity sectors play an important role in overall R&D investment in the EU because they account for a high proportion of total R&D. In the current survey, this has a dampening effect on the total growth expectations. Even without the automobiles & parts sector, the expected growth is also moderate for other sectors in this group such as chemicals, fixed line telecommunications and industrial engineering. As shown in the figure above, most R&D activity in these sectors happens outside the EU.

Should these expectations be realised, the EU countries' share of R&D investment would slightly decrease in the coming years, while the proportions invested in all the other world areas except Japan would increase (Figure 19).

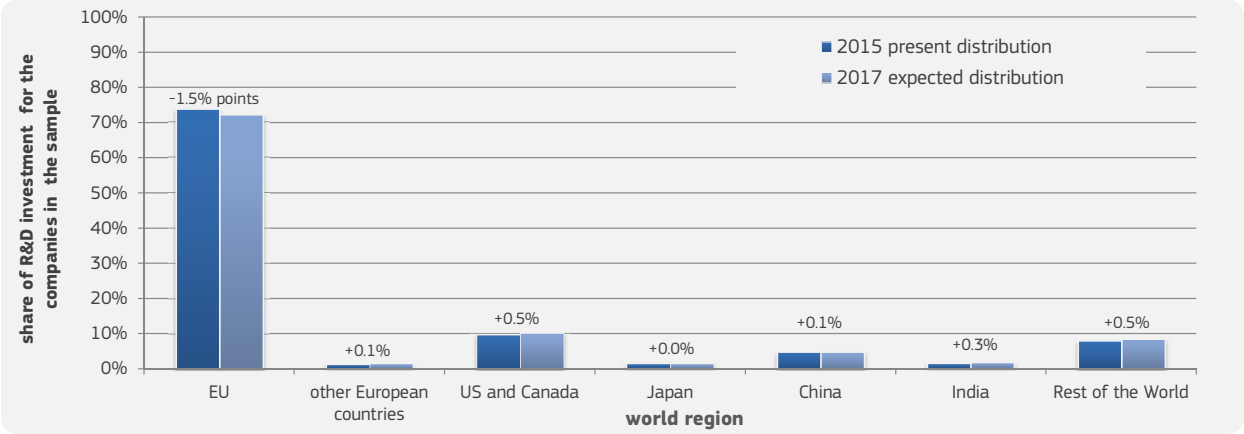


FIGURE 19 – R&D INVESTMENT PROPORTIONS IN 2014 AND EXPECTED IN 2017, BY WORLD REGION

Note: The figure refers to 122 (40 high R&D intensity, 56 medium and 26 low) out of the 157 EU companies in the sample, weighted by R&D investment and after elimination of outliers, representing 30% of the total R&D investment by the 1000 EU Scoreboard companies. Other EU countries include Switzerland, Norway and others, while the rest of the world includes a heterogeneous set of countries such as South Korea, Taiwan, and Brazil. See also Annex B: Questionnaire question D.8 R&D location strategy.

Source: European Commission JRC-B (2016)

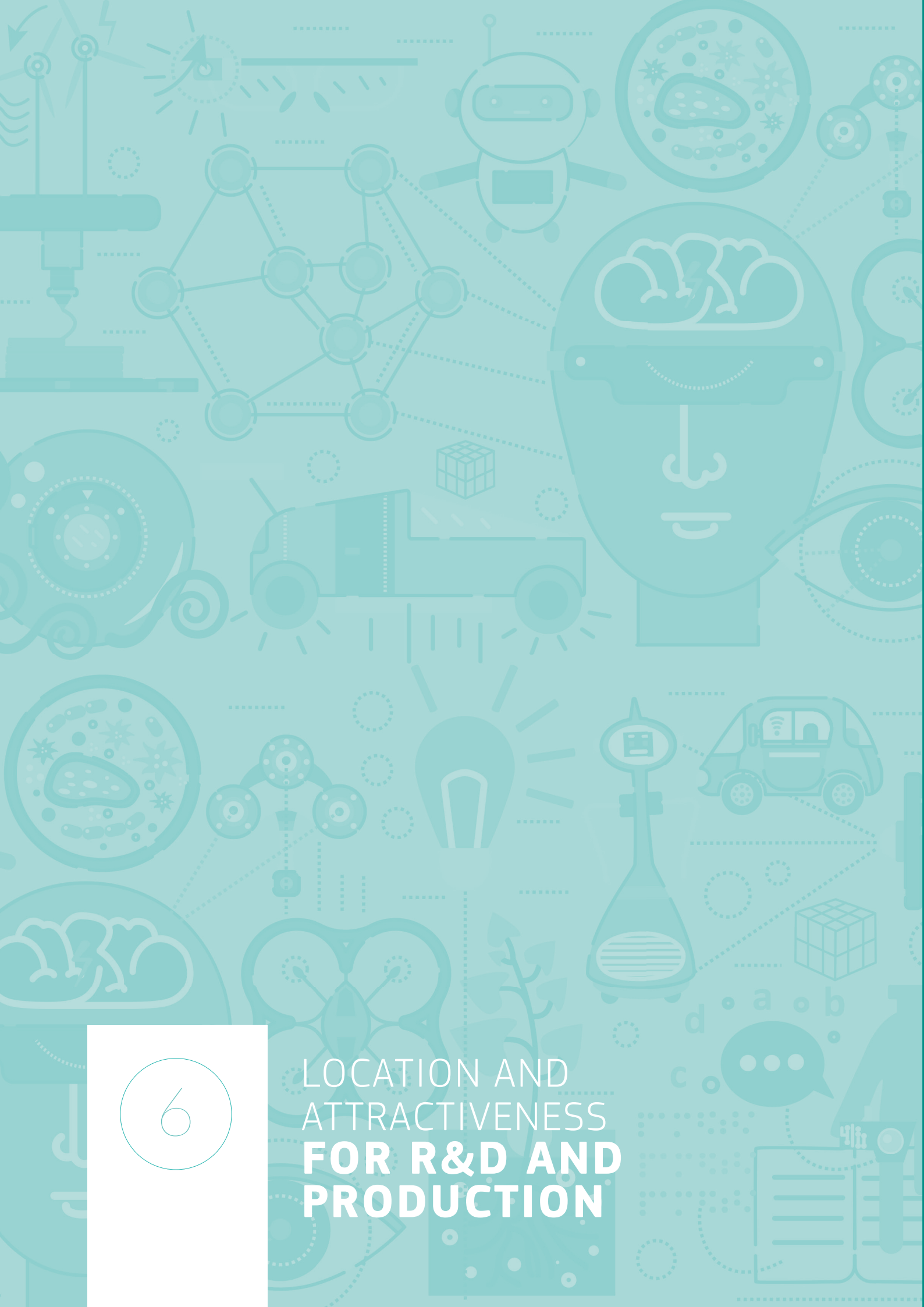
Higher expectations for R&D investment growth outside the EU have also been observed in seven of our previous surveys. As these expectations were within similar dimensions[21], this can be considered a trend. The patterns were always similar, with the highest growth rates expected for China and India, followed by the United States and Canada, while forecasts for other world regions remained at more modest levels. Expectations for Japan and other European countries have been the most moderate ones for the third year in a row, and are now even negative.

It should be pointed out that the above picture of a decreasing relative share being invested in R&D in the EU occurs within the context of overall increases in the absolute amounts invested in R&D in most world regions. The only decreases are expected in Japan and are a relatively modest amount (around 1% of the expected total).

Including the automobiles & parts sector, the expected nominal R&D investment increases in the EU constitute roughly a quarter of the total (€ 178 million out of € 780 million per year over the next two years). This goes up to roughly half when the automobiles & parts sector is excluded (€ 421 million out of € 971 million per year over the next two years).

In both cases, R&D investment growth is not expected to continue to follow the present distribution. In the future, a larger proportion of R&D investment growth is expected to the outside the EU and the rest inside. In our previous surveys, the share of R&D investment growth expected to be inside and outside the EU used to be half and half. The above underlines the importance of the medium R&D intensity sectors, and especially automobiles & parts for the R&D in the EU. However, it is also a sign of the increasing participation of European companies in the global economy, and in particular in emerging economies, while they retain their R&D focus inside the EU. It again confirms that the gap between the R&D invested by the surveyed companies in the EU and in countries such as China and India has not widened significantly.

[21] The only exception was the 2008 survey, where R&D investment was expected to stagnate owing to the impact of the economic and financial crisis in autumn 2008.



6

LOCATION AND ATTRACTIVENESS **FOR R&D AND PRODUCTION**

6 Location and attractiveness for R&D and production

Our survey asks the respondents to rank the top three countries for both R&D and production activities together with the factors that influence the decision about where to locate these activities. This section presents the main countries in which R&D activities are located and their attractiveness factors and then repeats this exercise for the location of production activities.

6.1 | Countries where the company's main R&D activities are located

Having R&D activities in different countries seems to be a key strategy for global top R&D investors. Almost two thirds of the survey participants perform R&D in at least three countries. Roughly a quarter (22%) has R&D activities in two countries and 12% have them only in one country[22]. In many cases, the reason for spreading the geographical presence of R&D is to cover the US/North America, Europe and Asia as major economic areas (96 out of the 145 companies mention presence in all three regions). The most frequently mentioned combination of R&D countries in this context is Germany, the US and China (seven times). However, the home-base effect is very strong here: all these companies are based in Germany. The combination of the US and China within the top three R&D locations was also mentioned another five times.

Beyond the global presence of R&D activities in more than one country, 83% of the respondents mention their home base as the country where the highest proportion of R&D is currently being performed, which shows that there is certainly some path dependency underlying the location of R&D activities. Among the companies whose home country is one of the three main locations for R&D activities, 90% perform the highest proportion of R&D at their home base. Looking at the most popular country for performing R&D activities outside the home-base country (Figure 20), the United States is clearly in the lead (43% of the respondents perform R&D activities here), followed at a considerable distance by Germany (17%) and China (14%).

Of non-EU countries, the United States and India remain among the most popular locations for R&D activities. It is surprising to see how China is similarly popular to last year's survey as the country with the second highest R&D volume (named five times compared with four), and named no less than 16 times as the country with the third most R&D; last year's survey did not ask for the third country.

[22] Firm size is an important factor in the geographical presence: the companies that distribute R&D activities over three countries are on average much larger in terms of (R&D) employees: an average of 35 958 employees (of whom 2 724 are R&D employees) compared with 4 956 (221 R&D) employees for firms that have R&D activities in two countries and 8 326 (200 R&D) employees for firms that perform R&D in one country only.

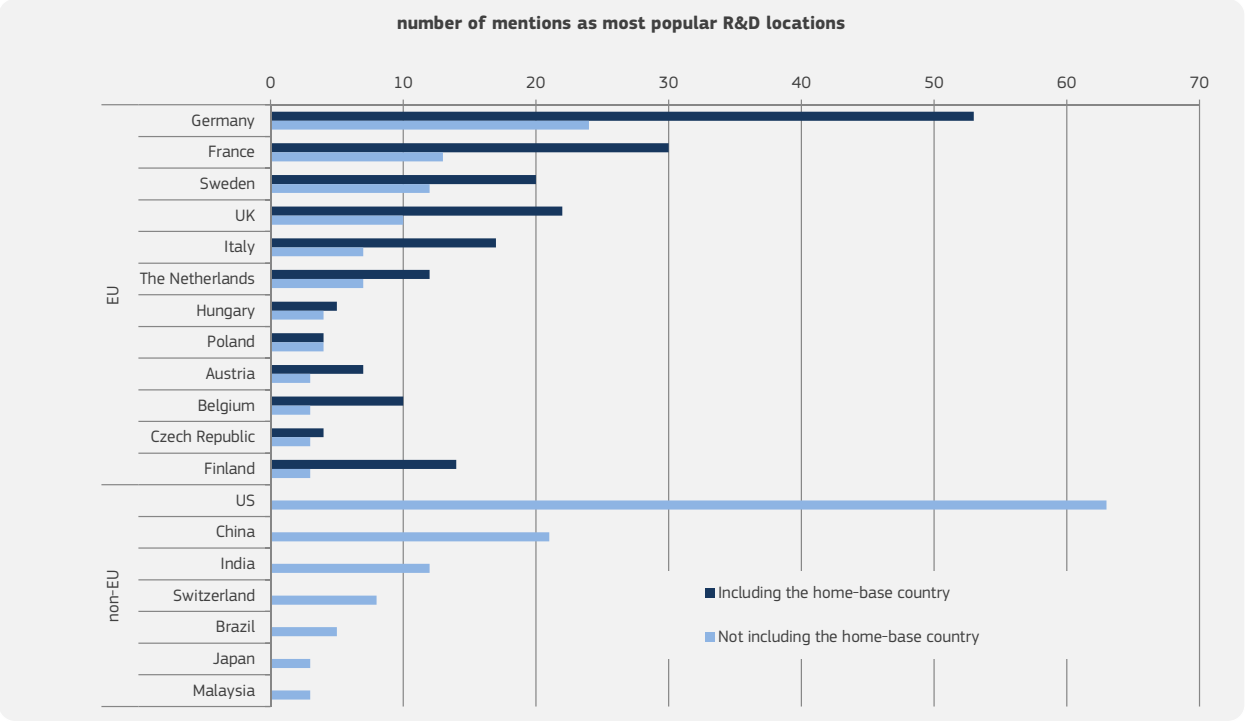


FIGURE 20 – MOST POPULAR COUNTRIES FOR THE COMPANY'S R&D

Note: The figure refers to 146 (50 high R&D intensity, 67 medium and 30 low) out of the 157 companies in the sample, representing 33% of the total R&D investment by the 1000 EU Scoreboard companies. Numbers of mentions refer to one of the three countries currently considered the most attractive location for the company's R&D activities. Only for countries mentioned at least five times.

Source: European Commission JRC-B (2016)

If we look at the sector level (Figure 21), the US is the most popular country for R&D activities outside the home-base for firms from the high-, medium- and low-tech sectors. China is the second most popular country to perform high-tech R&D, above Germany, the UK and India. For medium-tech R&D activities, Germany is the second most popular country, above China and Sweden.

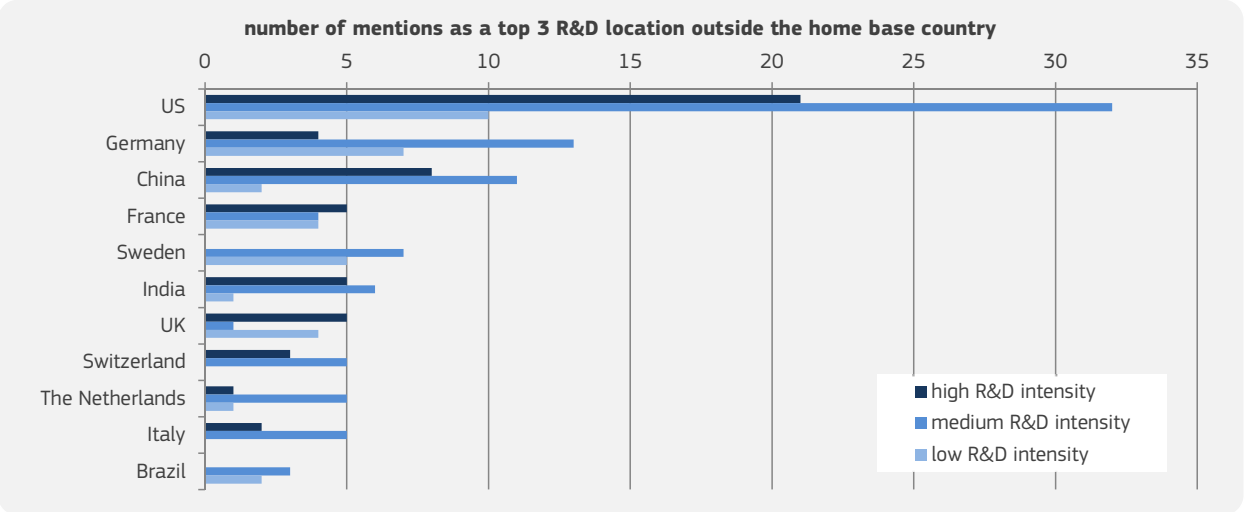


FIGURE 21 – MOST ATTRACTIVE COUNTRIES FOR THE COMPANY'S R&D OUTSIDE THE HOME-BASE COUNTRY

Note: The figure refers to 146 (50 high R&D intensity, 67 medium and 30 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies. Numbers of statements refer to one of the three countries currently considered the most attractive location for the company's R&D activities. Only for countries mentioned at least five times.

Source: European Commission JRC-B (2016)

If we dig deeper into the sector level, as far as the number of observations allows, Figure 22 shows that the US leads the location of R&D in three of the five sectors with more than 10 observations: Chemicals, Pharmaceuticals & Biotechnology and Electronic & Electronical Equipment. Germany is the most popular country for locating R&D activities in the Industrial Engineering and Industrial Metals & Mining, both being traditional sector in Germany.

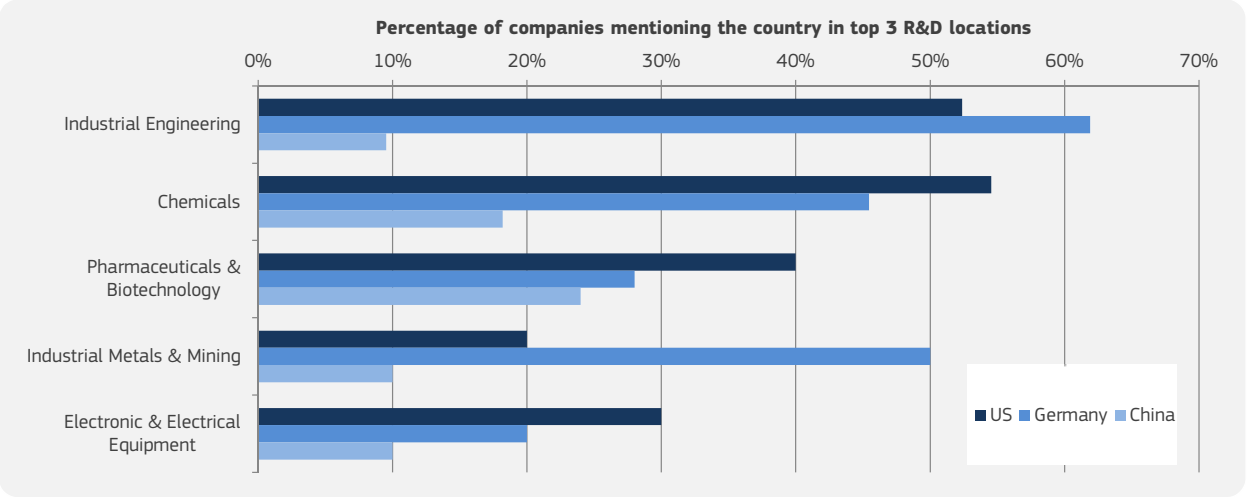


FIGURE 22 – PERCENTAGE OF MENTIONS OF US, GERMANY AND CHINA AS ONE OF THE THREE MAIN R&D LOCATIONS

Note: The figure refers to 77 out of the 157 companies in the sample representing 9% of the total R&D investment by the 1000 EU Scoreboard companies. Numbers of statements refer to one of the three countries currently considered the most attractive location for the company's R&D activities.

Only for sectors with at least 10 observations.

Source: European Commission JRC-B (2016)

The questionnaire also looked at the factors for locating R&D activities, where access to knowledge, availability of researchers and proximity to other company activities play the main role (see Figure 23). As in our previous surveys, labour costs for researchers do not seem to be an important factor, especially for the medium- and low-R&D-intensity sectors, where process innovation traditionally has a bigger role than in high-R&D-intensity sectors, which focus more on product innovation. The low-R&D-intensity sectors are also less concerned with the regulatory framework for protecting intellectual property.

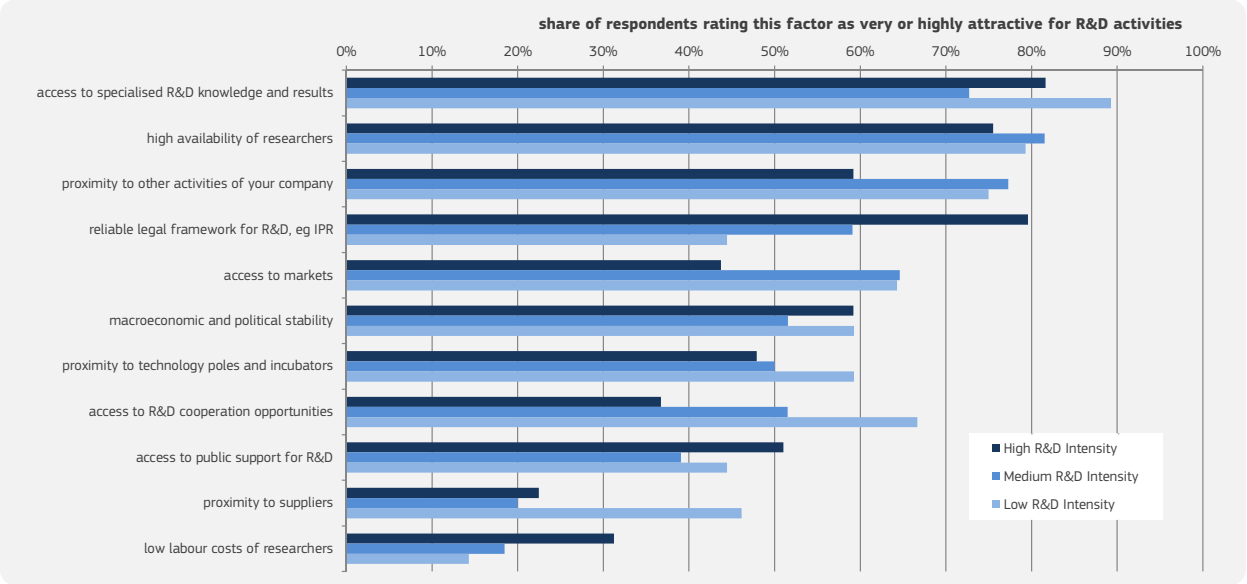


FIGURE 23 – FACTORS FOR THE ATTRACTIVENESS OF R&D LOCATIONS

Note: The figure refers to 151 (48 high R&D intensity, 65 medium and 28 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2016)

6.2 | Countries where the main company's production activities are located

This subsection addresses the locations of the company's production activities and their main drivers. The production activities are even more distributed over various countries than those in R&D: 83% of the respondents declare that they perform production activities in at least three countries; 9% of the firms locate production activities in only one country; and 8% concentrate production activities in just two countries[23]. Production activities are also less concentrated in the three main regions: 89 out of 145 companies mention production activities in all three of North America, Europe and Asia, which is less than the distribution of R&D activities.

The most mentioned within-company combination of top three locations of production activities is – as with R&D activities – Germany, the United States and China (nine times). Again, these are only German-based companies.

Production activities seem to be less a result of path dependency than R&D activities: 68% of the respondents mention their home base as the country where the highest share of production is currently performed. Among the companies whose home country is one of the three main locations for R&D activities, 77% perform the highest proportion of production at their home base. For R&D, these shares are 83% and 90%, respectively.

The top three countries for production activities outside the home base are similar to the top three for R&D activities: the United States (20%), Germany (10%) and China (8%), although with much less concentration in these three countries (43%, 17% and 14%, respectively). It is interesting to see that Switzerland is much less favoured for production than for R&D.

[23] As in the case of R&D activities, size matters: the companies that distribute production activities over three countries are on average much larger in terms of employees: an average of 34 608 employees compared with 4 767 (two countries) and 5 428 (one country).

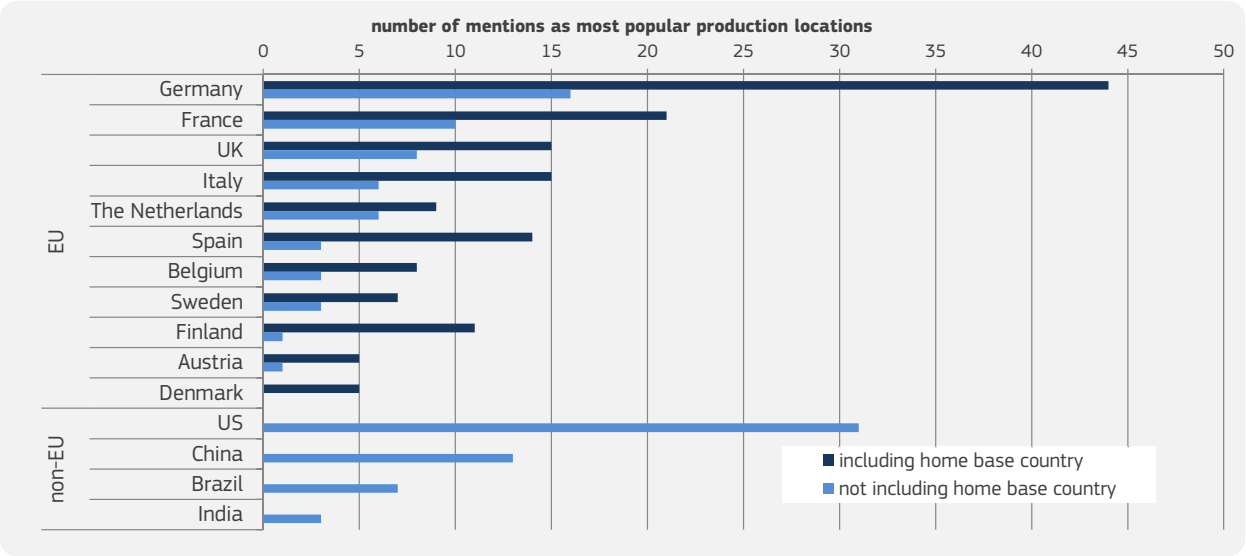


FIGURE 24 – MOST POPULAR COUNTRIES FOR THE COMPANY'S PRODUCTION

Note: The figure refers to 156 (51 high R&D intensity, 72 medium and 33 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies. Numbers of statements refer to one of the three countries currently considered the most attractive location for the company's R&D activities. Only for countries mentioned at least five times.

.Source: European Commission JRC-B (2016)

If we look at the sector level, Figure 25 shows that the US is the most popular country for production activities outside the home base in high-, medium- and low-tech sectors. China and especially Germany are much less popular for production among companies in high-R&D-intensity sectors, but more popular for production activities in medium- and (in the case of Germany) low-tech sectors.

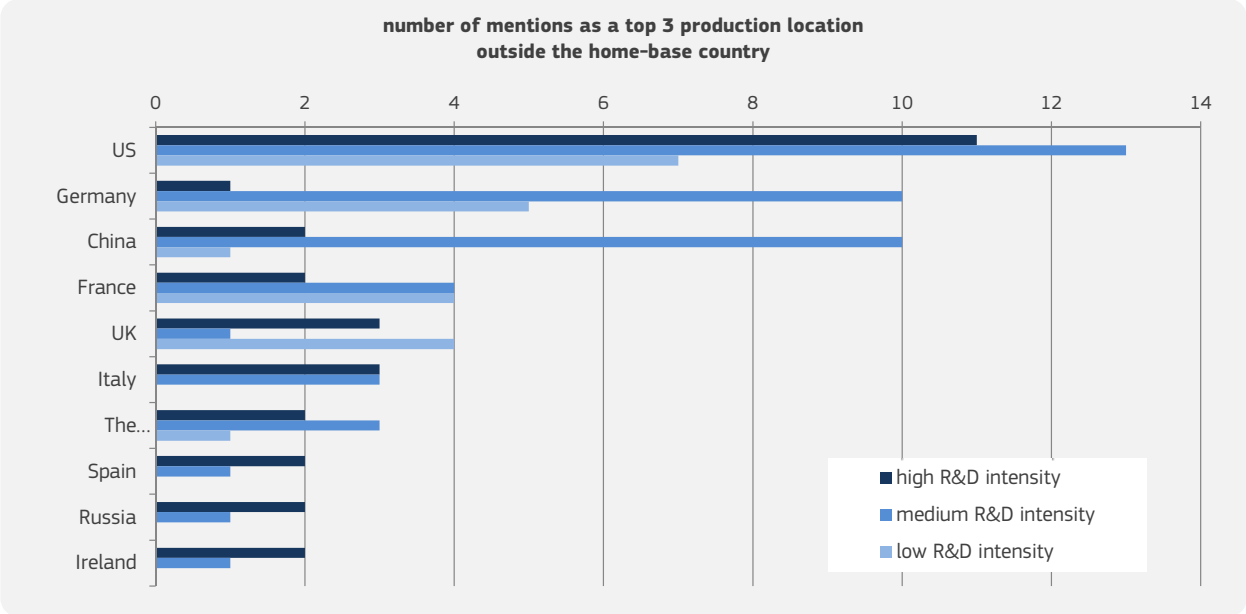


FIGURE 25 – MOST ATTRACTIVE COUNTRIES FOR THE COMPANY'S PRODUCTION OUTSIDE THE HOME-BASE COUNTRY

Note: The figure refers to 156 (51 high R&D intensity, 72 medium and 33 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies. Numbers of statements refer to one of the three countries currently considered the most attractive location for the company's R&D activities. Only for countries mentioned at least five times.

.Source: European Commission JRC-B (2016)

For the sectors with at least 10 observations, Figure 26 shows the percentage of companies that mention either Germany, the US or China as preferred locations for production activities. The US leads the location of production activities in three of the four sectors with more than 10 observations: Industrial Metals & Mining, Chemicals and Pharmaceuticals & Biotechnology. Germany is the most popular country for locating R&D activities in the Industrial Engineering and Electronic & Electrical Equipment. Compared with the popularity of R&D locations, the most striking difference is that the United States and Germany are much less attractive locations for production activities than for R&D activities. For China this difference is much less noticeable.

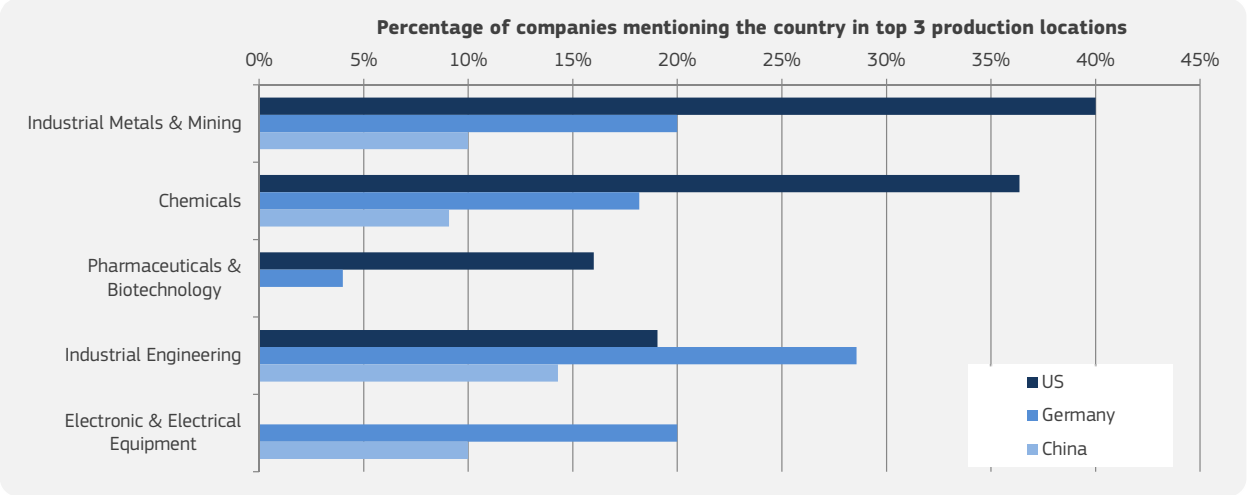


FIGURE 26 – POPULARITY OF US, GERMANY AND CHINA AS PRODUCTION LOCATION AMONGST SELECTED SECTORS

Note: The figure refers to 81 out of the 157 companies in the sample representing 9% of the total R&D investment by the 1000 EU Scoreboard companies. Numbers of statements refer to one of the three countries currently considered the most attractive location for the company's R&D activities.

Only for sectors with at least 10 observations.

.Source: European Commission JRC-B (2016)

6.3 | Factors for locating production activities

The factors for production location are very different from the R&D location factors (Figure 27). Access to markets is the main factor, especially in the case of the medium- and low-tech sectors. Macroeconomic and political stability is also an important factor, followed by high availability of personnel (especially for high-R&D-intensity companies), access to production infrastructure and proximity to other company activities.

Firms from the high-tech sectors base decisions about the location of production activities on different factors from medium- and low-tech firms. They attach more value to the availability of human resources, knowledge and regulation, in terms of both product markets and other aspects (environmental, red tape, etc.).

Overall, low levels of employment protection are the least important factor in making a country attractive for locating production activities. For firms from low-tech sectors, only low labour costs are less important, which is highly remarkable, since these firms typically operate at high volumes of production and small marginal profits.

The relatively low importance of cheap labour and low employment protection reveals the importance of focusing on a stable single EU market with a highly educated workforce to attract production.

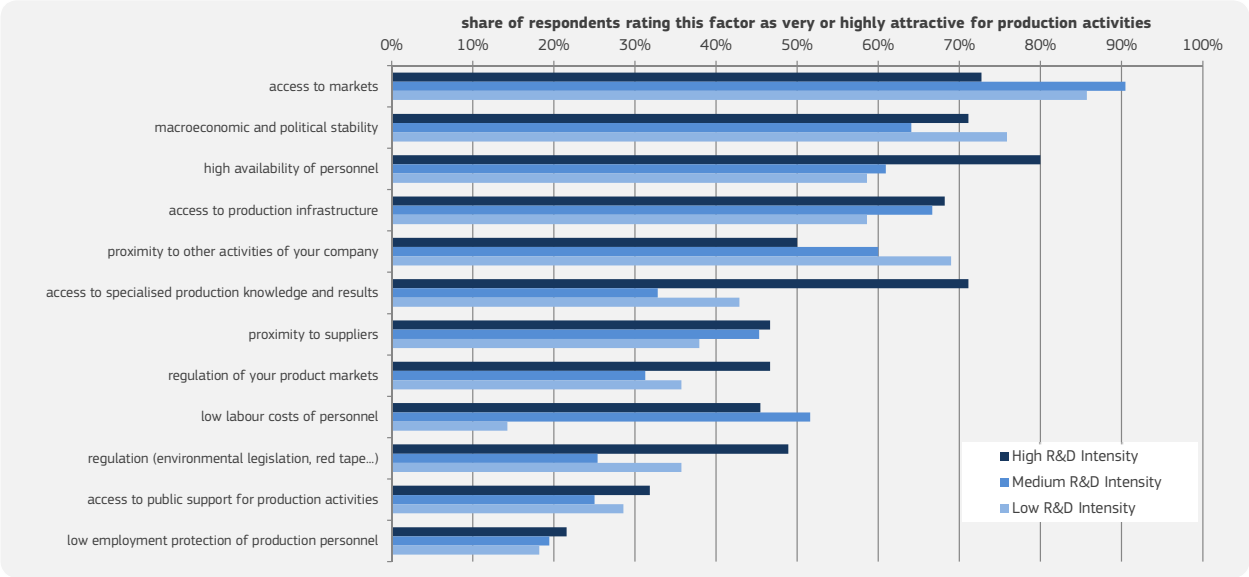


FIGURE 27 – FACTORS FOR THE ATTRACTIVENESS OF PRODUCTION LOCATIONS

Note: The figure refers to 151 (51 high R&D intensity, 72 medium and 33 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies.

.Source: European Commission JRC-B (2016)

6.4 | Attractiveness factors of R&D vs. production locations

In the following table, we can see that the countries that are more frequently mentioned as a top 3 production location than an R&D location are China, Brazil, Poland and Russia. In contrast, the US, Sweden, India (surprisingly), Switzerland, France and Denmark are more often mentioned as an R&D location than as a production location. The general trend seems to be that production is more often located in countries with lower labour costs.

Country	Difference between mentions as a production and an R&D location	
China	13	more frequently mentioned as production location
Brazil	6	
Poland	4	
Russia	4	
Denmark	-4	more frequently mentioned as R&D location
France	-4	
Switzerland	-4	
India	-6	
Sweden	-10	
US	-12	

TABLE 3 – DIFFERENCE BETWEEN MENTIONS AS A PRODUCTION AND AN R&D LOCATION

Note: The table refers to 151 (48 high R&D intensity, 65 medium and 28 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies. Differences

.Source: European Commission JRC-B (2016)

Comparing the factors for attractiveness of R&D and production locations, Figure 28 shows that the factors for which the average scores vary most are access to markets (most important for location of production activities, but much less so for R&D activities) and access to knowledge (vice versa). This makes perfect sense from a business strategic point of view. Other factors that are more important for locating R&D activities than for production activities are the availability of skilled personnel and proximity to other activities within the company.

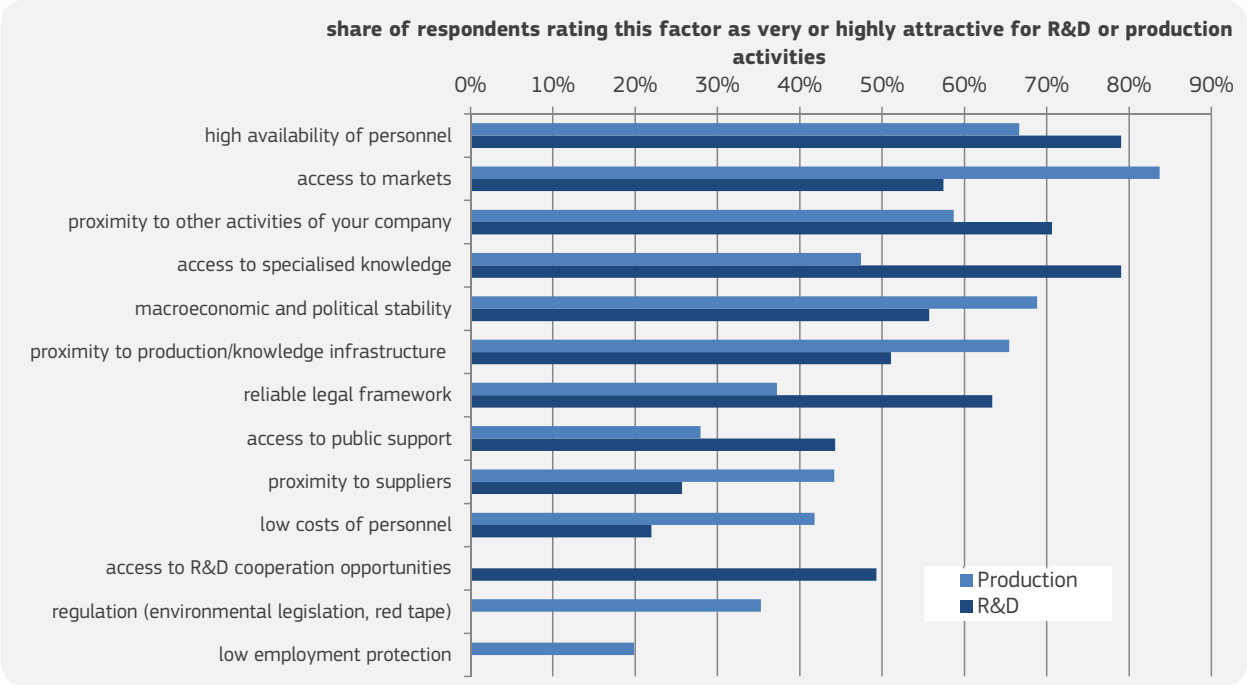


FIGURE 28 – ATTRACTIVENESS FACTORS OF R&D VS. PRODUCTION

Note: The factors are grouped by the average relevance of the major items in the survey.

The figure refers to 151 (51 high R&D intensity, 72 medium and 33 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2016)

To show the relationship between the location of R&D and production facilities, the overlap of these activities at the country level is addressed. Of the companies in the survey, 75% perform the highest proportion of their R&D at the place where the main production activities are. This figure decreases to 67% if the firm is also headquartered in the same country.

If we look not only at the (one) main location but at the top three locations, we see that only 3 out of 151 respondents mention a complete geographical division between top R&D and production activities. An interesting detail here is that all three of them mention China as one of the main production locations, but do not name China as one of the three main R&D locations. This is further supported by the relatively high importance given to the location of (especially) the R&D activities closer to other activities within the firm. All this indeed shows the close connection between production and R&D, which is remarkably equal across the high-, medium- and low-tech sectors. This shows the importance of co-location of production and R&D, which is remarkably equal amongst high, medium and low-tech sectors.

7

STRUCTURAL
REFORMS FOR R&D

7 Structural reforms for R&D

The Commission is pushing for important structural reforms[24]. The survey participants were asked to rate on a scale from 1 (no potential) to 5 (very high potential) a set of 16 structural reforms grouped in 6 different categories[25]according to their potential impact on the increase of the company's R&D and innovation[26] activities. Figure 29 shows the percentage of companies that consider every proposed reform to have a high (4) or very high (5) potential in terms of impact on its R&D and innovation activities

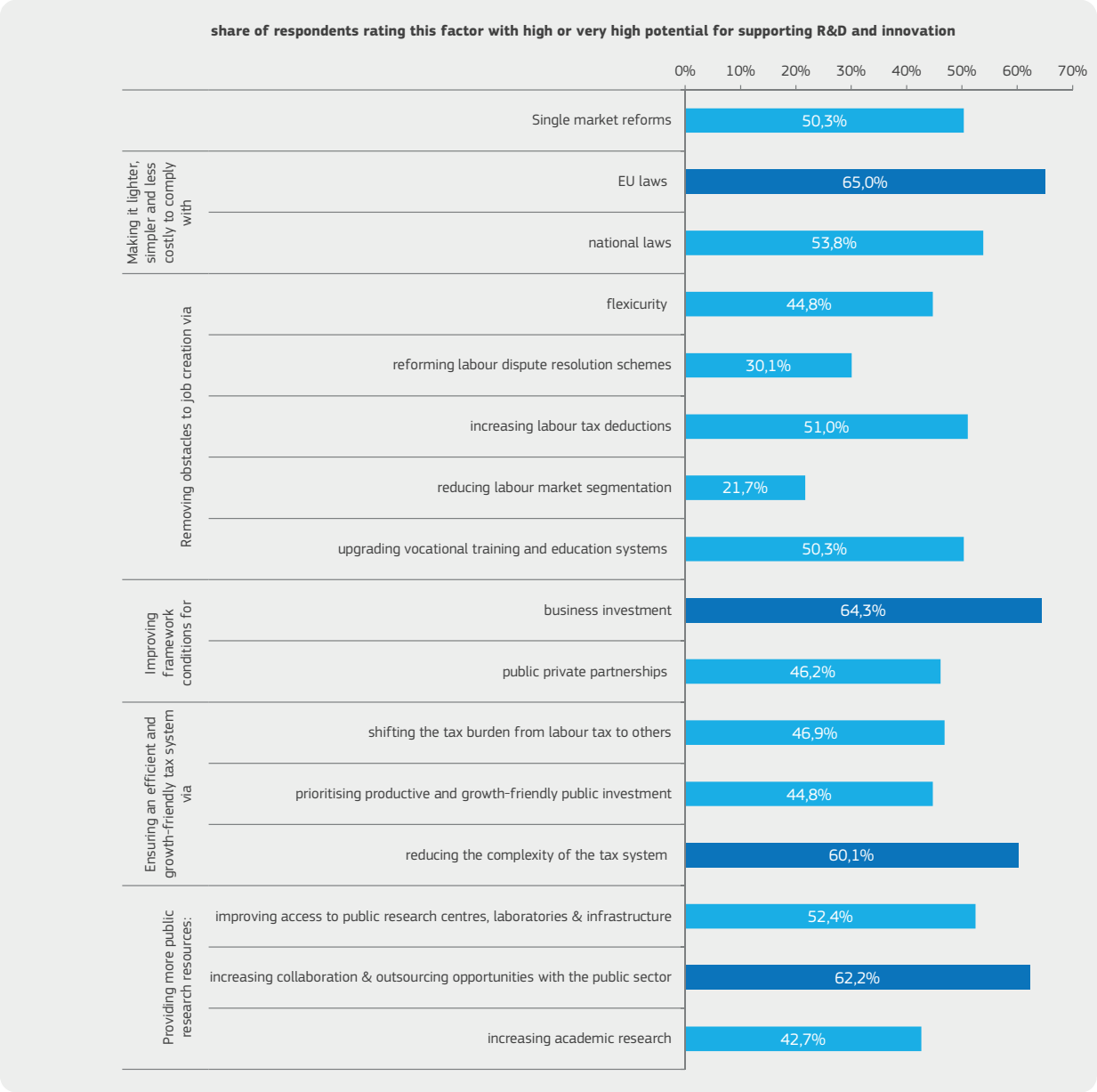


FIGURE 29 – POTENTIAL OF STRUCTURAL REFORMS FOR INCREASING R&D AND INNOVATION

Note: The figure refers to 143 (49 high R&D intensity, 66 medium and 28 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies.

.Source: European Commission JRC-B (2016)

The four reforms with the highest potential impact on the respondents R&D and innovation activities cover four out of the six proposed policy groups. This indicates a preference for both a policy mix and a specific policy among those proposed within each group.

In general, the respondents seem to consider that reforms linked to product market and market regulations have a potentially higher impact on their R&D and innovation activities than reforms linked to the labour market. More specifically, the reform indicated to have the highest potential impact is the simplification of regulation at the EU level, followed by the improvement of framework condition for business investment, more public support for public research centres and infrastructures, and a reduction in the complexity of the tax system. In contrast, the reduction in the segmentation in the labour market and the reform of the labour dispute resolutions schemes are the bottom two in terms of potential impact.

		High R&D intentsity	Medium	Low
	Single market reforms allowing free flow across national borders of goods, services and energy	51,0%	51,5%	46,4%
Making it lighter, simpler and less costly to comply with	EU laws	63,3%	68,2%	60,7%
	national laws	57,1%	56,1%	42,9%
Removing obstacles to job creation via	flexicurity	46,9%	43,9%	42,9%
	reforming labour dispute resolution schemes	38,8%	25,8%	25,0%
	increasing labour tax deductions	55,1%	50,0%	46,4%
	reducing labour market segmentation	14,3%	30,3%	14,3%
	upgrading vocational training and education systems	53,1%	48,5%	50,0%
Improving framework conditions for	business investment	69,4%	60,6%	64,3%
	public private partnerships	44,9%	43,9%	53,6%
Ensuring an efficient and growth-friendly tax system via	shifting the tax burden from labour tax to others, e.g. property, environment or consumption tax	55,1%	48,5%	28,6%
	prioritising productive and growth-friendly public investment	40,8%	43,9%	53,6%
	reducing the complexity of the tax system	67,3%	60,6%	46,4%
Providing more public research resources:	improving access to public research centres, laboratories & infrastructure	57,1%	48,5%	53,6%
	increasing collaboration & outsourcing opportunities with public research centres, laboratories & infrastructure	65,3%	60,6%	60,7%
	increasing academic research	44,9%	40,9%	42,9%

TABLE 4 – POTENTIAL OF STRUCTURAL REFORMS FOR INCREASING R&D AND INNOVATION

Note: The table refers to 143 (49 high R&D intensity, 66 medium and 28 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies.

Source: European Commission JRC-B (2016)

[24] See: "The 2015 Annual Growth Survey": http://ec.europa.eu/europe2020/pdf/2015/ags2015_en.pdf

[25] (a) Single market reforms; (b) Making it lighter, simpler and less costly to comply with regulation; (c) Removing obstacles to job creation; (d) Improving framework conditions; (e) Ensuring an efficient and growth-friendly tax system; (f) Providing more public research resources.

[26] Innovation is the introduction of new or significantly improved products, services, or processes.

The responding companies see the greatest potential for their R&D and innovation activities in policies promoting a more business-friendly environment, making it simpler to comply with regulation and tax obligations, and engaging the public sector more in public research for basic and fundamental science. This seems in line with the priority set by the Commission's Investment Plan for Europe, with its 'third pillar' aiming to create an investment-friendly environment[27].

Table 5 disaggregates the replies depending on the R&D intensity of the sector group the company belongs to.

The table shows that, when looking at different R&D-intensity groups, the four reforms mentioned above score more than 60% on positive potential impact. The only exception is the reduction in the complexity of the tax system, which companies in the low-R&D-intensity sectors do not see as having a significant impact. The general preference for reforming product markets and market regulations over the labour market can also be observed when looking separately at the three different R&D-intensity groups.

[27] See: http://ec.europa.eu/priorities/jobs-growth-and-investment/investment-plan_en.

ANNEXES

- ANNEX A: METHODOLOGY
- ANNEX B: QUESTIONNAIRE

A.1 Annex A: Methodology

Background and Approach

The European Commission's Industrial Research and Innovation Monitoring and Analysis 2016-17 (IRIMA II)[28] initiative serves to better understand industrial R&D and innovation in the EU and to identify medium and long-term policy implications. IRIMA is carried out by the European Commission's Joint Research Centre (JRC) Directorate B, Growth & Innovation, and the Directorate General for Research Directorate A, Policy Development & Coordination. The project monitors and analyses industrial R&D and innovation activities in order to support the implementation and monitoring of the European research and innovation agenda: the Innovation Union flagship, set in the context of the Europe 2020 strategy aiming at a smarter, greener and more inclusive economy. The evidence gathered also contributes to policy-making in the «Industrial Policy», the «Digital Agenda» and the «New Skills for New Jobs» flagship initiatives.

The present IRIMA surveys tackles the lack of comparable information on business R&D investment trends at the European level by gathering qualitative information on factors and issues surrounding and influencing companies' current and prospective R&D investment strategies. The survey complements other R&D investment related surveys and data collection exercises (e.g. Innobarometer, Eurostat data collection and other on-going surveys).

Link to the R&D Investment Scoreboards

The EU R&D surveys complement the *EU Industrial R&D Investment Scoreboard*[29], which is the main IRIMA product. The Scoreboard helps the European Commission to monitor and analyse company R&D investment trends and to benchmark, inform and communicate developments in R&D investment patterns.

The Scoreboard and the Survey take different perspectives on the industrial R&D dynamics in companies. The Scoreboard looks at trends ex-post based on the audited annual accounts of companies, whereas the Survey improves the understanding of the Scoreboard companies by collecting ex-ante information. The survey also addresses location strategies, drivers and barriers to research and innovation activities, or perception of policy support measures with a questionnaire agreed between JRC-B and DG-RTD. This questionnaire is printed and mailed by post together with the Scoreboard analysis report and the previous Survey analysis report to the 1000 European companies. Also a web-interface and email contacts are made available in order to allow for paperless participation. The Survey makes efficient use of the direct contacts established with the European Scoreboard companies by adding-on to the Scoreboard mailing when the reports are officially released.

For the 2016 Survey, the response period ran for three months: from 10th March (mailing of the questionnaires) to 10th June 2016 (reception of the last response).

[28] See: http://iri.jrc.ec.europa.eu/.

[29] The Scoreboard is published annually and provides data and analysis on the largest R&D investing companies in the EU and abroad (see: http://iri.jrc.ec.europa.eu/research/scoreboard.htm).

Methodology

To improve response rates, the following measures were taken in the course of the survey cycle:

1. The questionnaire was revised and streamlined with a view towards keeping it as short and concise as possible and minimise the burden for the respondent.
2. The questionnaire was sent together with the Scoreboard report to take advantage of this occasion as a door-opener.
3. The cover-letter presented a full colour figure and table with a benchmarking analysis of the company addressed compared to its peers in the same sector.
4. As well as physically sending the questionnaire to each company, an online site was provided to facilitate data entry via the European Commission's EU Survey tool[30], where a Word version of the questionnaire was downloadable for offline information input.
5. The questionnaire was emailed to the respondents of previous surveys, together with a link to the electronic copy of the latest analysis.
6. The contact database was continuously improved. Respondents who had already participated in previous surveys, or their substitutes in cases where they had left their position, were priority contacts. Returned questionnaires and reminder mailings were resent using the latest contact information on the internet or by contacting the company directly via email or phone.
7. The response rate is closely followed on a regular basis during the implementation. If necessary, measures for improving the response rate are applied, e.g. by adjusting the number of reminders, allowing more time for questionnaire reception, following up selected candidates by e-mail and phone or searching support from former survey participants
8. Personal contact by phone or email was made with several dozen companies when the deadlines were close, especially for those which had participated in the past.

The response rate has been steadily high over the past five years, taking full advantage of the familiarity of the EU Scoreboard companies with the exercise and their mature approach[31].

Outliers were detected by analysing the distribution of the dataset in scatter and boxplots and defining upper and lower quartiles ranges around the median, according to the variable(s) analysed. To maintain the maximum information in the data, outliers were eliminated only in extreme cases and after assessing the impact on the result[32].

One-year growth is simple growth over the previous year, expressed as a percentage: 1yr growth = 100*((C/B)-1); where C = current year amount and B = previous year amount. 1yr growth is calculated only if data exist for both the current and previous year. At the aggregate level, 1yr growth is calculated only by aggregating those companies for which data exist for both the current and previous year.

Three-year growth is the compound annual growth over the previous three years, expressed as a percentage: 3yr growth = 100*(((C/B)^(1/t))-1); where C = current year

[30] See: https://ec.europa.eu/eusurvey/

[31] The response rate of the present survey is 16.2%. This is slightly lower compared to the 18.5% of last year due to a two-week shorter response period. The responsiveness per day has been very steady over the past five surveys.

[32] For the systematic detection of outliers, an adjusted methodology from the NIST/SEMATECH e-Handbook of Statistical Methods was applied, see: http://www.itl.nist.gov/div898/handbook/prc/section1/prc16.htm

amount, B = base year amount (where base year = current year - 3), and t = number of time periods (= 3). 3yr growth is calculated only if data exist for the current and base years. At the aggregate level, 3yr growth is calculated only by aggregating those companies for which data exist for the current and base years.

Unless otherwise stated, the **weighted figures** presented in this report are weighted by R&D investment.

R&D Investment Definition

To make the survey as easy to complete as possible and to maximise the response rate, only a short definition of R&D investment is provided in the survey[33]. The definition refers mainly to R&D as reported in the company's most recent accounts. The definition used in the survey is thus closely related to the International Accounting Standard (IAS) 38 "Intangible Assets"[34], based on the OECD "Frascati" manual[35], and the definition used in the EU Industrial R&D Investment Scoreboards.

Composition of the Responses

The 157 responses were classified according to the ICB classification[36]. Sector classifications of individual companies were cross-checked with the Scoreboards. The sectors were grouped according to their average R&D intensities in the Scoreboard as follows:

- High (more than 5%) R&D-intensity (51 companies): Aerospace & Defence, Health Care Equipment & Services, Pharmaceuticals & Biotechnology, Software & Computer Services, Technology Hardware & Equipment.
- Medium (between 2 and 5%) R&D-intensity (73 companies): Alternative Energy, Automobiles & Parts, Chemicals, Commercial Vehicles & Trucks, Electronic & Electrical Equipment, Financial Services, Fixed Line Telecommunications, Food Producers, General Industrials, Household Goods & Home Construction, Industrial Engineering, Industrial Machinery, Media, Oil Equipment, Services & Distribution, Personal Goods, Support Services.
- Low (less than 1%) R&D-intensity (33 companies): Banks, Construction & Materials, Electricity, Forestry & Paper, Gas, Water & Multi-utilities, Industrial Metals & Mining, Industrial Transportation, Mining, Oil & Gas Producers.

Table 5 shows the distribution of the responses among the sectors with their respective R&D investment shares.

[33] See Annex B

[34] See http://www.iasplus.com/standard/ias38.htm

[35] See "Proposed Standard Practice for Surveys on Research and Experimental Development: Frascati Manual", OECD, Paris, 2002, http://www1.oecd.org/publications/e-book/9202081E.PDF

[36] ICB Industry Classification Benchmark (see: http://www.icbenchmark.com/docs/ICB_StructureSheet_120104.pdf)

ICB SECTOR	NUMBER OF RESPONSES	NUMBER OF SCOREBOARD COMPANIES	RESPONSE RATE BY SECTOR	TOTAL R&D INVESTMENT SHARE COMPARED TO THE SCOREBOARD*	R&D INTENSITY SECTOR GROUP**
Pharmaceuticals & Biotechnology	25	122	20,5%	between 20 and 40 %	High
Software & Computer Services	9	112	8,0%	below 20 %	High
Aerospace & Defence	6	25	24,0%	below 20 %	High
Health Care Equipment & Services	6	37	16,2%	between 20 and 40 %	High
Technology Hardware & Equipment	5	50	10,0%	between 20 and 40 %	High
other high R&D-intensity sectors	0	6	0,0%		High
Subtotal high R&D intensity sectors	51	352	14,5%	22,9%	
Industrial Engineering	22	101	21,8%	between 20 and 40 %	Medium
Chemicals	11	42	26,2%	above 40 %	Medium
Electronic & Electrical Equipment	10	68	14,7%	below 20 %	Medium
Automobiles & Parts	7	47	14,9%	above 40 %	Medium
General Industrials	5	37	13,5%	above 40 %	Medium
Other medium R&D intensity sectors	18	184	9,8%		Medium
Subtotal medium R&D intensity sectors	73	479	15,2%	45,7%	
Industrial Metals & Mining	14	19	73,7%	above 40 %	Low
Banks	6	27	22,2%	between 20 and 40 %	Low
Other low R&D intensity sectors	13	123	10,6%		Low
Subtotal low R&D intensity sectors	33	169	19,5%	17,8%	
Total	**157**	**1000**	**15,7%**	**33,9%**	

TABLE 5 – DISTRIBUTION OF THE RESPONSES BY SECTORS

Note: * For confidentiality reasons, R&D investment shares of individual sectors are shown in ranges and only shown For sectors with at least five responses.

** Sector group according to the average Scoreboard R&D-intensity of each sector.

Source: European Commission JRC-B (2016)

Most of the responses, both in terms of numbers of participants and share of R&D investment in the sample, were from the medium R&D-intensity sectors (see also Figure 4 of the section 2 R&D Investment Expectations). The number of responses by home country is shown in Table 6 below. According to the Scoreboard methodology, the home country is the country of registered office of the company. Similar to our previous surveys, most participants were from companies located in the three biggest Member States.

COUNTRY	NUMBER OF RESPONSES	R&D INVESTMENT SHARE OF THE SAMPLE
Germany	33	65,6%
UK	20	2,8%
France	19	7,8%
Spain	14	4,8%
Finland	12	0,7%
Italy	11	1,5%
Sweden	9	10,9%
Belgium	8	1,0%
The Netherlands	8	1,7%
Denmark	7	1,6%
other European countries	16	1,6%
total	**157**	**100%**

TABLE 6 – DISTRIBUTION OF THE RESPONSES BY HOME COUNTRY OF THE COMPANY

Note: Only information for countries with at least four responses is shown.

Source: European Commission JRC-B (2016)

Figure 30 reveals that the average survey respondent is a very large company[37]. However, there are differences in company size between the sector groups.

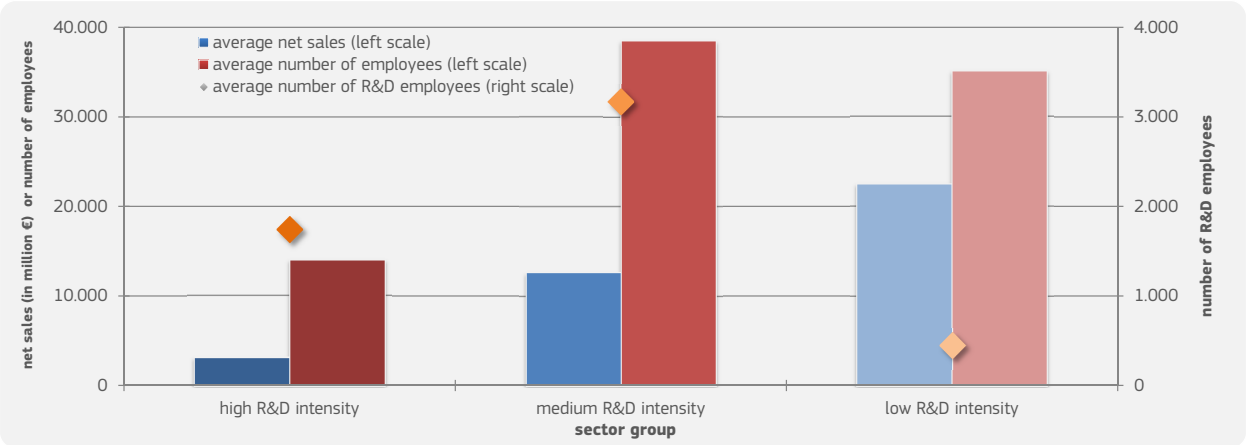


FIGURE 30 – AVERAGE TURNOVER AND EMPLOYEE NUMBERS FOR THE RESPONDING COMPANIES, BY SECTOR GROUP

Note: The figure refers to 151 (51 high R&D intensity, 72 medium and 33 low) out of the 157 companies in the sample representing 33% of the total R&D investment by the 1000 EU Scoreboard companies..

Source: European Commission JRC-B (2016)

[37] The average turnover of the responding companies was €13 billion, 33 000 employees, and 2 125 employees in R&D. Among the 162 respondents there were 3 medium-sized and one small company mainly in the high R&D intensity sectors (according to the European Commission's SME definition, see: http://ec.europa.eu/enterprise/enterprise_policy/sme_definition/index_en.htm). Among the large companies in the sample, 14 had between 251 and 1 000 employees, 71 between 1 001 and 10 000 employees, 37 between 10 001 and 30 000 employees, and 37 more than 30 000 employees.

In terms of average net sales and number of employees, the high the R&D-intensity companies are much smaller than those in the medium and low R&D intensity sectors. The average number of R&D employees of the companies surveyed is around six to seven times bigger in high and medium than in the low R&D-intensity sector. This is the result of the high share of R&D employees in large companies that responded from technology, hardware & equipment, and aerospace & defence (high R&D intensity), automobiles & parts, electronic & electrical equipment and chemicals (medium R&D intensity) sectors.

A.2 Annex B: Questionnaire

Questionnaire on Business R&D Investment

We would very much appreciate your response by (**deadline)**, **preferably by using the online questionnaire** at:

https://ec.europa.eu/eusurvey/runner/business-RandD-investment2016

Alternatively, you may return this completed form by e-mail (Alexander.Tuebke@ec.europa.eu), fax (+34.95.448.83.26), or post[38].

The information in your response will be treated as strictly **confidential**. It will only be used within this study and in an aggregated form. The European Commission is committed to the protection and privacy of data[39].

It will take about **30-35 minutes** to complete the questionnaire.

We will automatically inform you of the results of the survey once they are available (for that purpose, please ensure that you have provided your e-mail address below).

Name of the company you are responding for: _____
Its primary sectors of activity: _____
Your name: _____
Job title: _____
E-mail: _____
Phone number: _____

The European Commission may follow up this survey by short-interviews to clarify major trends revealed in the analysis. If you *do not* wish to be contacted for this purpose, please **tick here** ☐.

Definition of R&D investment

For the purposes of this questionnaire, **'R&D investment' is the total amount of R&D financed by your company** (as typically reported in its accounts). It does not include R&D financed from public sources.

[38] European Commission, Institute for Prospective Technological Studies (IPTS), Attn.: Alexander Tübke, Edificio Expo, Calle Inca Garcilaso 3, E-41092 Seville, Spain, Tel.: +34.95.448.83.80

[39] See the Privacy Statement on the last page

A. Corporate background

1 Number of employees in your company in the past year (2015)?

Around _____ (FTE[40]).

2 How many employees have worked on R&D in the company in the past year (2015)?

About _____ (FTE[3]).

3 In approximately how many countries were these R&D employees located?

In approximately _____ countries.

B. R&D investment levels and trends

4 What was your R&D investment in the past year (2015)?

About € _____ million.

5 How much of this R&D investment would fall into the following categories?

(a) Basic research (includes exploratory) _____%

(b) Technology development (patented or not) _____%

(c) Development for market launch _____%

(d) Development for adapting products to local markets _____%

(e) Development of software/data _____%

(f) Management of R&D projects _____%

(g) other (please specify): _____%

6 At what average rate do you expect the company to change its overall R&D investment over the next two years (2016 and 2017)?

About _____% per annum.

[40] Please indicate the number of employees on either permanent or fixed-term contracts in Full-Time Equivalents (FTE), with part-time employees included on a pro-rated basis in line with their contractual working hours.

C. R&D drivers

7 **How relevant are the following drivers for this expected R&D investment change?**
Please rate on a scale from 1 (irrelevant) to 5 (highly relevant).

	Irrelevant 1	2	3	4	Highly relevant 5
(a) Market pull	☐	☐	☐	☐	☐
(b) Exploiting technological opportunities (technology push)	☐	☐	☐	☐	☐
(c) Maintaining R&D as a fixed proportion of net sales	☐	☐	☐	☐	☐
(d) Competition from companies located in:					
(d1) the European Union	☐	☐	☐	☐	☐
(d2) other developed countries, e.g. the US or Japan	☐	☐	☐	☐	☐
(d3) emerging countries, e.g. China or India	☐	☐	☐	☐	☐
(e) Improving the company's productivity	☐	☐	☐	☐	☐
(f) Meeting product market regulation and other legal frameworks	☐	☐	☐	☐	☐

(g) Other (please specify):

D. R&D location strategy

8 **Please estimate the distribution of your company's in-house R&D activity among the following world areas in the past year (2015) and two years later (2017)?**

DISTRIBUTION IN 2015	R&D CARRIED OUT:	**EXPECTED** DISTRIBUTION IN 2017
%	In the european union[41]	%
%	In other european countries[42]	%
%	In the us and canada	%
%	In japan	%
%	In china	%
%	In india	%
%	In the rest of the world	%

[41] There are currently 28 EU Member States: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta,
Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

[42] Examples of other (non-EU) European countries are: Switzerland, Norway, Iceland, Albania, Moldova, Turkey, Russia, Belarus and the Ukraine (for further examples see the recognised states in: http://en.wikipedia.org/wiki/List_of_sovereign_states_and_dependent_territories_in_Europe#Recognised_states).

9 **Please state the three countries where your *main R&D activities* are currently located, *ranked by order of importance*:**

1. _____ 2. _____ 3. _____

10 **Which factors render a country attractive for *locating your R&D*?**
Please rate on a scale from 1 (not attractive) to 5 (highly attractive).

		Not attractive 1	2	3	4	Highly attractive 5
(a)	Access to markets	☐	☐	☐	☐	☐
(b)	High availability of researchers	☐	☐	☐	☐	☐
(c)	Low labour costs of researchers	☐	☐	☐	☐	☐
(d)	Access to specialised R&D knowledge and results	☐	☐	☐	☐	☐
(e)	Reliable legal framework for R&D, e.g. Intellectual Property Rights	☐	☐	☐	☐	☐
(f)	Macroeconomic and political stability	☐	☐	☐	☐	☐
(g)	Proximity to technology poles and incubators	☐	☐	☐	☐	☐
(h)	Proximity to other activities of your company	☐	☐	☐	☐	☐
(i)	Proximity to suppliers	☐	☐	☐	☐	☐
(j)	Access to R&D cooperation opportunities	☐	☐	☐	☐	☐
(k)	Access to public support for R&D	☐	☐	☐	☐	☐
(l)	Other (please specify):	☐	☐	☐	☐	☐

E. Production location strategy

11 **Please state the three countries where your *main production activities* are currently located,** *ranked by order of importance*:

1. _____ 2. _____ 3. _____

12 **Which factors render a country attractive for *locating your production*?**
Please rate on a scale from 1 (not attractive) to 5 (highly attractive).

		Not attractive 1	2	3	4	Highly attractive 5
(a)	Access to markets	☐	☐	☐	☐	☐
(b)	High availability of personnel	☐	☐	☐	☐	☐
(c)	Low labour costs of personnel	☐	☐	☐	☐	☐
(d)	Low employment protection of production personnel	☐	☐	☐	☐	☐
(e)	Access to specialised production knowledge and results	☐	☐	☐	☐	☐
(f)	Macroeconomic and political stability	☐	☐	☐	☐	☐
(g)	Proximity to other activities of your company	☐	☐	☐	☐	☐
(h)	Proximity to suppliers	☐	☐	☐	☐	☐
(i)	Access to production infrastructure	☐	☐	☐	☐	☐
(j)	Access to public support for production activities	☐	☐	☐	☐	☐
(k)	Regulation (environmental legislation, red tape...)	☐	☐	☐	☐	☐
(l)	Regulation of your product markets	☐	☐	☐	☐	☐
(m)	Other (please specify):	☐	☐	☐	☐	☐

[43] "Technology poles" are areas where R&D active companies, institutions and universities are concentrated.

[44] "Incubators" are structures that support innovative start-up companies in order to increase their survival rates.

F. Structural reforms supporting R&D and innovation

13 **The European Commission is pushing for important structural reforms[46]. In this context, what potential do the following initiatives have for *increasing* your company's R&D and innovation[47] activities?** *Please rate on a scale from 1 (no potential) to 5 (very high potential).*

	No potential 1	2	3	4	Very high potential 5
Single market reforms allowing free flow across national borders of goods, services and energy	☐	☐	☐	☐	☐
Making it lighter, simpler and less costly to comply with:					
(b1) EU laws	☐	☐	☐	☐	☐
(b2) national laws	☐	☐	☐	☐	☐
Removing obstacles to job creation via:					
(c1) flexicurity (flexibility measures combined security for employees)	☐	☐	☐	☐	☐
(c2) reforming labour dispute resolution schemes	☐	☐	☐	☐	☐
(c3) increasing labour tax deductions	☐	☐	☐	☐	☐
(c4) reducing labour market segmentation	☐	☐	☐	☐	☐
(c5) upgrading vocational training and education systems to provide the necessary skill sets	☐	☐	☐	☐	☐
Improving framework conditions for:					
(d1) business investment	☐	☐	☐	☐	☐
(d2) public private partnerships	☐	☐	☐	☐	☐
Ensuring an efficient and growth-friendly tax system via:					
(e1) shifting the tax burden from labour tax to others, e.g. property, environment or consumption tax	☐	☐	☐	☐	☐
(e2) prioritising productive and growth-friendly public investment	☐	☐	☐	☐	☐
(e3) reducing the complexity of the tax system	☐	☐	☐	☐	☐
Providing more public research resources:					
(f1) improving access to public research centres, laboratories & infrastructure	☐	☐	☐	☐	☐
(f2) increasing collaboration & outsourcing opportunities with public research centres, laboratories & infrastructure	☐	☐	☐	☐	☐
(f3) increasing academic research	☐	☐	☐	☐	☐
Other (please specify):	☐	☐	☐	☐	☐

⇨ _____

G. Your final comments or suggestions

⇨ _____

_____

_____

_____

Thank you very much for your contribution!

[45] i.e. rules concerning hiring (for the disadvantaged, for temporary or fixed-term contracts, training) and firing (e.g. redundancies, prenotification, severance pay, dismissals and short-time work), see the OECD Employment Outlook.

[46] See: "The 2015 Annual Growth Survey": http://ec.europa.eu/europe2020/pdf/2015/ags2015_en.pdf

[47] Innovation is the introduction of new or significantly improved products, services, or processes.

PRIVACY STATEMENT

The *2016 EU Survey on R&D Investment Business Trends* is carried out by the Industrial Research and Innovation (IRI) action of the European Commission's Joint Research Centre (JRC), Institute for Prospective Technological Studies (IPTS). The survey is directed at the 1000 European companies in the *2015 EU Industrial R&D Investment Scoreboard*.

The European Union is committed to data protection and privacy as defined in Regulation (EC) nº 45/2001. This survey is under the responsibility of the IRI action leader, Fernando Hervás Soriano, acting as© the Controller as defined in the above regulation. The Controller commits himself dealing with the data collected with the necessary confidentiality and security as defined in the regulation on data protection and processes it only for the explicit and legitimate purposes declared and will not further process it in a way incompatible with these purposes. These processing operations are subject to a Notification to the Data Protection Officer (DPO) in accordance with Regulation (EC) 45/2001.

Purpose and data treatment

The purpose of data collection is to establish the analysis of the *2016 EU Survey of R&D Investment Business Trends*. This survey has a direct mandate from the Commission's 2003 Action Plan "Investing in Research" (COM 2003 (226) final, see http://ec.europa.eu/invest-in-research/action/2003_actionplan_en.htm). The personal data collected and further processed are:

- Company: name, primary sectors of activity, company size
- Contact Person: name, job title, phone number, e-mail

The collected personal data and all information related to the above mentioned survey is stored on servers of the JRC-B, the operations of which underlie the Commission's security decisions and provisions established by the Directorate of Security for these kind of servers and services. **The information you provide will be treated as confidential and aggregated for the analysis.**

Data verification and modification

In case you want to verify the personal data or to have it modified respectively corrected, or deleted, please write an e-mail message to the address mentioned under "Contact information", by specifying your request. Special attention is drawn to the consequences of a delete request, in which case any trace to be able to contact you will be lost. Your personal data is stored as long as follow-up actions to the above mentioned survey are necessary with regard to the processing of personal data.

Contact information

In case you have questions related to this survey, or concerning any information processed in this context, or on your rights, feel free to contact the IRI Team, operating under the responsibility of the Controller at the following email address: **jrc-ipts-iri@ec.europa.eu**.

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